[A Standard Work on Indian Music]

Useful alike to the students of both the NORTHERN (HINDUSTANI) as well as the SOUTHERN (CARNATIC) School.

ENGLISH TEXT BOOK
ON THE
THEORY & PRACTICE OF INDIAN MUSIC

It is an absolutely **Original Research Work** based on the principles
stated in the pre-ancient Sanskrit treatises '**Bharata-Natya-**
Shastra' and '**Sangeet Ratnakar**'. It is a
reproduction of the author's Hindi Shruti
Theory books in English language
with further additions.

Composed and Published by

PANDIT FIROZE FRAMJEE, SANGEET SHASTRI,
Research Scholar and Author of 35 Books on Indian Music.
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Vidyapitha (Registered), Moradabad.

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A Few of the Many Letters of Appreciation

OPINION
OF
His Highness SHRI VIJAYADEVJI, Maharana Saheb of Dharampur, President, Bharateeya Sangeet Samitee.

Mr. Firoze Framjee has been for years busy examining the traditions and technique of Hindustani Music. He has published several books and articles on Hindustani music. He has recently published a book entitled 'Bharatya Shruti-Swara Raga Shastra'. He has classified 170 Ragas in this volume according to the 'Murchana' system. It is true that he has thus attempted to simplify an important problem of 'Murchana'. He has devoted many years of study and research to prepare himself for the work of which the present volume is the result.

It is indisputable that the problems of the 'Shrutis' in Hindustani music do require intense study and research. Students and exponents of music would, therefore, feel greatly indebted to Mr. Firoze Framjee for having in some measures smoothed their path. The present volume ought to be read and studied by them. It will be to their advantage.

By order,
Sd /- B. J. MODY,
Personal Assistant to
Maharana Saheb of Dharampur State.
12th March 1936.

OPINION
OF
Rai Saheb H. L. VARMA, M.B.E., Deputy Commissioner, Balaghat, C. D.

This is to say that I have known Pandit Firoze Framjee of Poona for some years. He has published a very large number of books on Indian music and in some of them he has satisfactorily explained the Scale and Shruti. As regards the problem of Shrutis he must have devoted considerable labour in studying old books to comprehend their correct significance. He has advanced the cause of Indian Music considerably by writing the books in easy language and notation. His labours in this direction deserve recognition.

Sd./- H. L. VARMA,
Rai Saheb, M.B.E.,
Balaghat, C.D.
30-7-36.

Author

PANDIT FIROZE FRAMJEE,

SANGEET SHASTRI

Research Scholar & Author of 35 Books on Indian Music.
Music Examiner, Nagpur University and The All India Sangeet Vidyapitha
(Registered), Moradabad.

OPINION

of G. H. RANADE, Esqr.,

Professor of Physics, Willingdon College.

Sangli, 28th March 1936.

Mr. Firoze Framjee of Poona is well-known in these parts for his selfless and untiring endeavours in the cause of Indian Music. Till now he has published in three different languages several valuable books illustrating with ' Chijas ', the high traditions of the art of Indian music. In his present publication ' Bharatya Shruti-Swara-Raga Shastra ' he has succeeded in making a sound presentation of the scientific aspect of Indian music.

The book is bound to be of great help to students of Indian Music especially in understanding the pros and cons of the Shruti problem. Due to the scanty internal evidence and the great distance of time between, the Shruti problem has always been a matter of controversy. But this does not mean that it need be given up for ever. It is in this spirit that fresh interpretations are always welcome.

Mr. Firoze Framjee is to be congratulated upon having published the present book giving a new and **almost convincing interpretation of the Shruti problem.**

Yours truly,
Sd./- G. H. RANADE,
Professor of Physics, Willingdon College.

OPINION

of ALI Janab RAJA MUHOMED NAWAB ALIKHAN, M. L.C.,

Talukedar, Akbarpur.

Lucknow, 3rd March 1934.

Dear Mr. Firoze,

Please accept my grateful thanks for the books on music which you have sent me. Your zeal in the cause of music is highly praiseworthy and I have no doubt that the Music-loving public will derive a great deal of pleasure and profit from your publications.

Yours Sincerely,
Sd./- NAWAB ALI KHAN.

Vital Need of General and Mass Education of Indian Music.

Music is one of our unmixed legacies from our forefathers. It is the glory of the exceptionally high genius of our pre-ancient rishis. This is the only legacy pure and impolluted, unlike our other heritages, which have been influenced by alien forces working both internally and externally. If such a legacy is left to the dogs unheeded, uncared for and unnourished, there can not be any stronger proof of our degeneration so as to under-value things that influence our cultured life.

The two-fold study (the practical and the theoretical or more precisely the **Art** and the **Science**) should, therefore, be a matter of general and mass education is a platitude. Music is not an isolated art as some seem to think. It forms a most necessary and important link in the great family of art. Its origin is to be looked for at the same source as that of others, its ideal functions are also the same.

If it is desired that Musical tastes shall not remain the prerogative of some cultured few as it is the case now, but shall penetrate the real hearts of all, both in the interests of the art and more so in the interest of the Indian culture, let me announce that it is only by making Music a **compulsory** School or College subject or in short by including it in our University courses we can surely mobilise the vital musical forces of our country and help in great measure the **Cultural Advance** of our people. Let me in passing pay my homage and respects to the authorities of certain Universities in India, who have tried to do something for the cause of Music by including it as a subject for academic career, though partially. Will the Indian Musical intelligentsia rise to the occasion ?

Introductory Remarks.

It is highly deplorable that we have at present lost contact with the finest traditions of our ancient musical art. If we hope to revive the true spirit and technical perfection, and thus regain what our Indian music has unfortunately lost, **the first thing new India badly needs to do**, is:—

(1) To re-discover the unique basis upon which it was built *in days of yore.*

(2) To discard the musical Scale of 12 Semi-tones prevalent in India and return to the traditional **Natural Scale of 22 Shrutis,**—the fruit of the exceptionally high genius of our pre-ancient rishis.

(3) To determine the Shruti Intervals, Fractional Ratios, Vibrations and Location on the speaking wire of all the notes of our Shruti-Scale.

(4) To determine the Shruti Intervals, Fractional Ratios and Vibrations of all the notes that are produced by **Sa, Ma** and **Pa** wires on the fixed frets of our Veena instrument.

(5) To determine by co-operation of voice and instrument the Shruti Intervals and Vibrations of the Scale-notes of all the Ragas that are in general use to-day and classify them according to our traditional shastric **Murchana system.**

(6) To get rid of the prevalent key-board crude music-box (better known as Harmonium) founded on the Western artificial scale of '**Equal Temperament**' and return to the instruments attuned to the spirit of her own music.

(7) To create real **Well-cultured Artists** and not mere **Machine-like Mechanics.**

Remember, "**No nation can prevail in the struggle for existence which is not scientifically equipped on all sides.**"

(Stead)

The afore-said long-needed deficiency in the Indian musical art is supplied by this treatise.

Author.

A Very Perfect Form of Music must have A Very Perfect Scale.

Musical Scale (from the Latin **Scala**, a staircase or ladder) i. e. Musical Sound-ladder. A term denoting the series of sounds used in Musical compositions.

The number of musical sounds (notes) producible, all differing in pitch, is theoretically infinite and practically very large, so that in a single octave a sensitive ear may distinguish 50 to 100 different notes. But if we were to take a number of these **at random** (as some of our past and present writers have done), or if we were to slide by a continuous transition from one sound to another considerably distant from it, we should not make what we call '**music.**' In order to do this, we must use only a certain small number of sounds forming **a determined series that are actually used in musical compositions,** and differing from each other by well-defined steps or degrees. Such a series or succession of sounds is called a '**Scale,**' from its analogy with the steps of a ladder. Shortly put, by Musical Scale is meant the collection of all the notes of musical compositions of a nation, comprised between the fundamental note and its octave, which succeed each other with a certain pre-established regularity.

It is unnecessary here to enter into the æsthetical reason for this. It must suffice to state that all nations, at all times, who have made music, have agreed in adopting such a selection, although they have not always selected the same series of sounds. A Musical Scale is always the product of the musical activity of a nation extending over a number of centuries. It is not established before music, but it is developed with it.

In modern Indian music, in ascending from the recognized tonic **Sa** to its octave above we employ, normally, a series of seven steps of unequal height, called the diatonic scale, with the power of interposing certain intermediate chromatic steps in addition. It is an accepted rule in music that every note (whether diatonic or chromatic) of the scale must have concordant harmonious relations to other notes, and in determining these, the relations to the tonic or keynote are the more important.

Proceeding in this way, we should obtain a number of chromatic notes forming a considerable addition to the diatonic scale. Out of these chromatic notes, **only those, that are actually sung and played in all the Ragas that are in general use to day,** are taken into consideration by the author in introducing a new diatonic scale by modulation, discarding the rest. This modern revival, based entirely on the pre-ancient Bharata's scale of seven Shuddha and two Kakli-Antar notes distributed among 22 Shrutis in the octave, is one of the latest simplifications ever known in the history of Indian music and has the effect of advancing the art to a great extent.

The Shruti system is the basis of ancient theory. The '**Shruti**' is the smallest perceptible difference of pitch of unequal size i. e. **the Shruti is not a fixed unit.** The octave is conceived as the sum-total of twenty-two such intervals. These twenty-two Shrutis have mathematical values and are conversant with the latest theory of musical sounds and ratios. Unfortunately our ancient shastra-writers have sedulously avoided applying mathematics to their scales. This avoidance of mathematics has caused the subject of the Indian scale to be extremely obscure, and the extraordinary **high-flown imagery** used by subsequent scholars has rendered the unravelling of their system the more difficult.

It is no fault of the Western scholars if they formed wrong impressions about the Scientific value of our Indian musical scale and consequently about our music also. It is purely the fault of the subsequent writers who have misinterpreted the Shruti theory of our ancient Shastra-writers. But to allow such wrong impressions to stand permanently on record and to suffer them to prejudice the minds of the Western and Oriental scholars as to the rank, which the Indian Musical Scale should take in the scales of Music in vogue, is very unbecoming in those who take a pride in the name of Aryans and is not creditable to the faculty of research amongst us. The author, therefore has, after years of intensive effort and research, succeeded in solving the problem of the traditional Shruti theory and proved **by concrete facts and accurate mathematical figures** in this treatise that **the scale used by our modern musicians is the same as that expounded by Bharata in the early part of the sixth century A. D.**.Thus the author has cleared up all the existing wrong impressions regarding Indian scale with a view to restore it to the rank which it fully deserves in the Musical Scales of the world. As the study of the musical scales presents one of the most important and concise means of judging the musical state of a nation, the study of the author's Shruti Scale will not fail to be a discovery in the matter of the high state of excellence achieved by India in this most artistic of arts.

The ancient Aryans originally cultivated music in connection with the performance of sacred rites and ceremonies. Their music was called '**Margi Sangeet**' (मार्गी संगीत). The note **Nishada** was the **first note** of the Saman scale. The note **Shadaja** means 'born of six' and indicates that this note which has now become the **common tonic**, was the **last** to arise in a downward series. Margi Sangeet was confined to purposes of ritual and was sung in seven Shuddha notes only.

Afterwards two more notes **Kakli-Nishada** and **Antar-Gandhara** were added by the sage Bharata. '**Jatis**' have done duty for Ragas in those days. The practice of music engendered in due course a keen desire for a more pleasurable style in which the creative faculty could find fullest expression. It was then that musical improvisation on a given melody-theme came into vogue with the system of **Ragas** and **Raginis**. This music is known as '**Desi Sangeet**' (देसी संगीत). The author's Natural Shruti Scale of 22 Tones in the octave is simply the sum-total of all the notes that are used in the prevalent 170 Ragas of Desi Sangeet. It is constructed not alone on the theoretical point of view like some past and present scholars, but **also on the practical one.** The author sincerely hopes that it will arouse an interest in Indian music amongst the nations of the West, so that they may also have the benefit of having Indian Shruti tones, **the want of which is so keenly felt in their music.**

Before concluding it will not be out of place to mention here that there is no difference of opinion as regards the fundamental principles and laws followed by the Scientists of the West and by our Shastra-writers of yore in explaining the theory of Music and Musical Scales. From the study of this treatise it will easily be seen that our ancient Shastra-writers were fully aware of the more important laws of harmonics, of simple ratios, of consonant and dissonant notes, and of other laws which have been treated of by all the Scientists of the West, before the latter have commenced to treat of the different musical scales and their history. The interval between the Keynote and its octave is very great; and it is simply beyond one's reason to understand how accurately and exactly our pre-ancient Shastra-writers have followed the modern Western Scientific principles in introducing other notes in this long interval. How delicate and accurate must have been their organs of hearing when they could reach **so near the truth**

unassisted by the paraphernalia of modern Science. The study of Harmonic series, to which our Shastra-writers attached great importance, offered to them a good precedent. **It is this natural progression of sound which forms the basis of the Indian melodic music.**

The scientific acoustic principles, embodied in the exquisite Indian stringed instruments with their rich overtones, are a living testimony to the fact that ancient India knew the laws of sound and applied them to music. The Indian Veena instrument alone is sufficient evidence of the development to which the musical art had attained even in those early days. Its existence in the same state of things, even down to the very details of the carving with which it is adorned, is a solid proof of its perfection which has stood the test of time. This goes to prove without any doubt that our music in the past was highly systematised and the system adoptod was the best for its needs. I would even go farther and say that the system adopted by our ancient Shastra-writers has been found suitable even for the classification and systematisation of all the modern Ragas, as will be quite evident from the study of this treatise. It is mainly the subsequent speculative minds who are solely responsible for the present grave deterioration in our most noble and ancient heritage of India. **It now badly needs to be revived with care and love.**

Notice

The author has bought the copyright of the Marathi booklet '**Matsarikruta Murchana**' and of all the articles published in the Marathi '**Bharatya Sangeet**' magazine by **Prof. G. B. Acharekar,** hence reproduction in any language without permission of the author of this treatise is strictly forbidden.

Shruti-Scales, constructed on Theoretical Point of View only, have No Technical Value in Music.

◆

As the traditional Shruti-scales of Bharata and Sarangdeva were unintelligible to the subsequent writers, some of them have worked out their own Shruti-scales as their fancies have led them. As already stated, the number of musical sounds in *an octave is* **theoretically infinite;** *consequently the number of* the Shruti-scales can also be **indefinitely great.** All these Shruti-scales have no technical value whatever, **unless it is definitely proved by genuine illustrations of various Raga-scales that their each and every note is made use of in all the prevalent Ragas.** Until *this solid proof is forthcoming,* these Shruti-scales are not worth even the cost of paper on which they are printed. Theoretically they may be correct, but practically they are of no use whatever for the study of the art. For this very reason they have not come into force and have remained *in their works discarded by the musical intelligentsia.*

From the study of this treatise it will be as clear as crystal that **each and every note** of the author's Shruti-scale of 22 Tones is made use of in all the modern 170 Ragas. All the Raga-scales are given with the **Shruti intervals** and **vibrations** *of their notes,* which will *enable the students to determine* their accurate pitch and samvadi (concordant) relationship. It is the **latest research,** ever known in the history of Indian music, which has the effect of advancing the art to an incalculable extent.

Note Signatures & Nomenclature.

As this treatise is published specially for the benefit of Indian students, simple Indian notation signs are used for various chromatic notes. The seven fundamental notes are printed in bold types.

As there is a very minute difference of 2 cents between Ati Atikomol and Atikomal notes, both are printed and distinguished alike as **Atikomal** notes in this treatise. It is far more advisable to distinguish all the notes by their Shruti-sankhya-vachaka names than by the prevalent vague terms like Atikomal, Komal, Tivra, Tivratar, etc..

Complete accuracy in the intervals of four, three and two Shrutis would demand 4.08, 3.64 and 2.24. They are the Whole Tone, Minor Tone and Semi Tone respectively.

It should be particularly born in mind that two consecutive Shrutis, which are separated from each other by the smallest interval of 20 cents, are always counted as **one Shruti** and also assume only **one Shruti-name** according to our traditional Shastric rule of '**Shruti Satharna Prakar.**' The note on the second Shruti is the '**Sankirna**' i. e. **augmented** or **sharpened note** of that on the first Shruti. Full details will be found in the body of the work.

For fuller details of the accompanying Shruti-scale please see charts No. 6 and 7 on page 46 and 48 respectively.

Notes of the higher octave are printed with a dot above the notes (**Ṡa**, **Ṙi**, **Ġa**, etc.) and those of the lower octave are printed with a dot below the notes (**Ṣa**, **Ṛi**, **G̣a** etc.) in this treatise. Only three octaves are used in our vocal artistic music.

Note Signatures & Nomenclature

Shruti Sankhya-vachaka names	Popular names	Western names	Names of Notes with Vibrations
			Tonic 240 **Sa.**
Sankirna Shrutik	Ati Atikomal	Diminished Soft Semi-tone	$252\frac{68}{81}$ $\underline{\underline{\text{Ri}}}$, $284\frac{4}{9}$ $\underline{\underline{\text{Ga}}}$, $379\frac{7}{7}$ $\underline{\underline{\text{Dha}}}$ and $426\frac{2}{3}$ $\underline{\underline{\text{Ni}}}$.
Laghu Dwishrutik	Atikomal	Soft Semi-tone	$253\frac{1}{3}$ $\underline{\underline{\text{Ri}}}$, $379\frac{11}{16}$ $\underline{\underline{\text{Dha}}}$.
Dwishrutik	Komal	Semi-tone	256 $\underline{\text{Ri}}$, 288 $\underline{\text{Ga}}$, 320 $\underline{\textbf{Ma}}$, 384 $\underline{\text{Dha}}$ and 432 $\underline{\text{Ni}}$.
Trishrutik	Tivra	Minor Tone	$266\frac{2}{3}$ Ri, 300 **Ga,** 400 Dha, 450 **Ni.**
Sankirna Trishrutik	Sankirna Tivra	Augmented Minor Tone	$303\frac{11}{27}$ S-Ga, $455\frac{1}{9}$ S-Ni.
Chatushrutik	Tivratar	Whole or Major Tone	270 **Ri,** $337\frac{1}{2}$ Ma, 360 **Pa,** 405 **Dha.**
Sankirna Chatushrutik	Sankirnra Tivratar	Augmented Whole Tone	$341\frac{1}{3}$ S-Ma.

(Latest Research)

❧ Natural Shruti-Scale of 22 Tones. ❧

Fundamental Scale of 7 Shuddha Notes.

Notes —	**Sa**,	4 **Ri**,	3 **Ga**,	2 $\underline{\textbf{Ma}}$,	4 **Pa**,	4 **Dha**,	3 **Ni**,	2 **Ṡa.**
Shruti Nos. —		4	7	9	13	17	20	22.
Vibrations —	240,	270,	300,	320,	360,	405,	450,	480.

Scale of 7 Shuddha Notes including Sub-tones.

Notes —	**Sa**,	$\underline{\underline{\text{Ri}}}$,	$\underline{\text{Ri}}$,	Ri,	**Ri**,	$\underline{\underline{\text{Ga}}}$,	$\underline{\text{Ga}}$,	**Ga**,	S-Ga,
Shruti Nos. —		2	2	3	4	5	6	7	7
Vibrations—	240,	$253\frac{1}{3}$,	256,	$266\frac{2}{3}$,	270,	$284\frac{4}{9}$,	288,	300,	$303\frac{1}{27}$,

Notes —	$\underline{\textbf{Ma}}$,	Ma,	S-Ma,	**Pa**,	$\underline{\underline{\text{Dha}}}$,	$\underline{\text{Dha}}$,	Dha,	**Dha**,	$\underline{\underline{\text{Ni}}}$,
Shruti Nos. —	9	11	11	13	15	15	16	17	18
Vibrations—	320,	$337\frac{1}{2}$,	$341\frac{1}{3}$,	360,	$379\frac{11}{16}$,	384,	400,	405,	$426\frac{2}{3}$,

Notes —	$\underline{\text{Ni}}$,	**Ni**,	S-Ni,	**Ṡa.**
Shruti Nos. —	19	20	20	22.
Vibrations —	432,	450,	$455\frac{1}{9}$,	480.

Two Additional Sub-tones.

(1) $252\frac{68}{81}$ Sankirna Shrutik (Diminished Soft Semi-tone) $\underline{\underline{\text{Ri}}}$ on Shruti No. 1

(2) $379\frac{7}{27}$ Sankirna Shrutik $\underline{\underline{\text{Dha}}}$ on Shruti No. 14.

Musical Scales of Europe.

A brief history of the musical scales at present in vogue in Europe will not be out of place here for the information of my readers.

In Europe they have, by the application of the law of simple ratios and of the resultant notes, formed out of those, two scales called the **Major Chord** and the **Minor Chord.** Supposing the tonic note makes 240 vibrations per second, the vibrations of all the notes of both the chords will be as follows:—

Major Chord—240, 270, 300, 320, 360, 400, 450, 480.

Minor Chord—240, 270, 288, 320, 360, 384, 432, 480.

From the study of this treatise it will be seen that the **Major Chord** is identical with our modern **Ma-Grama Scale,** while the **Minor Chord** corresponds with our **Darbari Scale.**

These two perfect chords, the **Major** and the **Minor,** form the keystone of the musical system of Europe. But music would be very poor if it were limited only to these two chords and to the few notes that compose them. In order to increase their resources and to acquire greater vigour and strength in the expression of their ideas, at the same time with a view to diminish excessive number of notes and to render practical execution more easy, attempts towards the beginning of the sixteenth century were made to divide the five full tones D, E, G, A and B of the Major Chord into ten half tones, thus forming the chromatic scale of 12 notes, or 13 including the upper octave. Hence has arisen the modern chromatic scale, according to what is called '**Equal Temperament**' as represented by seven white and five black keys on the Key-boards of the ordinary Piano, Organ, Harmonium, etc..According to this, the musical scale consists of twelve Semi-tones, each equal to a twelfth part of an octave, i. e. all the twelve notes at equidistance from each other. The seven fundamental notes of this Temperate Scale, to say nothing of the five chromatic notes, can be represented thus:—

$240, 269\frac{2}{5}, 302\frac{2}{5}, 320\frac{2}{5}, 359\frac{2}{5}, 403\frac{2}{5}, 453\frac{2}{5}, 480.$

If this Temperate Scale be compared with the mathematical Major Scale, it will be evident that, with the exception of the tonic note and its octave, none of the other notes coincide exactly. All the notes will appear somewhat modified to a greater or less degree. The natural scale, therefore, is dreadfully abused and distorted. Its obvious defect is that certain harmonic combinations produced by its notes are slightly imperfect and lose the satisfactory effect produced by harmonies perfectly in tune. It is an admitted fact that whenever a chord is not in perfect tune, it gives rise to unpleasant beats which spoil the harmony. On the piano these beats are not very perceptible, but on the organ and harmonium instruments with full, loud and sustained notes, they may be recognized in a most unpleasant degree especially when they are frequent.

For instance, an Indian musician sings 'alapa' (आलाप) of **Yaman** Raga with the accompaniment of harmonium, which is (unfortunately) very popular among Indian musicians at present. As every musician knows, the note **Ga** is very prominent and is the final note of all the 'Tanas' (तानें) of the alapa of Yaman Raga. Now as soon as the musician commences to sing the three notes **Ni, Ri, Ga** of the very first part of the alapa and extends the note **Ga,** the defect in the corresponding note of the Temperate scale of the harmonium will be at once perceived by sensitive ears and will appear discordant, not indeed loud enough to produce true dissonance, but sufficiently so to disturb the serene quiet and the transparency of a chord.

It, therefore, goes to prove without any doubt that the Western key-board instruments, founded on the artificial Temperate scale, are not suitable to the artistic melodic music of

India, as **there can be no melody without harmony.** It is far advisable for the Western musicians also to abandon this artificial scale and return to the natural scale in which a more *satisfactory solution of the great difficulties of musical execution* will be found than that furnished by the Temperate scale, which simple though it may be, is too rude. Remember, there can never be natural harmony in the music having an incomplete scale of only twelve notes. The scale of 12 Semi-tones is **ipso facto** incomplete as will be seen from the study of this treatise. Suffice it to say that harmony of Indian music, founded on the **natural** scale of 22 tones in the octave, is quite **natural**, while that of Western music, founded on the **artificial** *scale of 12 Semi-tones, is simply* **coarse** *and* **artificial.**

" All science as it grows towards perfection becomes mathematical in its ideas. "

Significance of Shruti Intervals And Vibrations of Notes.

The possible gradations of the pitch of musical sounds are infinite, but for the purposes of the art certain relative distances of height and lowness have to be definitely determined and maintained. The sounds so chosen are the **Notes** of the system and the distances between them are the **' intervals '**. With *different objects in view, different intervals between the* sounds have been determined on, and various national scales present great diversities in this respect.

In our Indian scales various intervals of the notes have been determined on according to their **Shruti** values. These **Shruti intervals** play a most important part in ascertaining the

accurate pitch of the notes. The popular terms Atikomal, Komal, Tivra, Tivratar, etc., for the notes have no technical value whatever, as they are too vague to ascertain their **exact pitch.** Owing to this vital deficiency in the scale-notes our musicians, though expert in their practical demonstrations, are unable to tell the accurate pitch of the notes they are singing or producing on their instruments. With due respect to the profession I would go farther and say that majority of them do not know the accurate pitch of **even the seven notes of our fundamental scale,** let alone the various sub-tones. The practical skill, they have acquired, is simply through **blind imitation,** purely relying upon the oral traditions and intonations (lit. rise and fall in the musical pitch of the voice) bequeathed to them for generations. Unfortunately they have little or no knowledge of the physics of sound, intervals, vibrations, etc.. Their whole attention is directed mostly towards the technical side of the art, hence they seriously lack in the æsthetical side of music. One fact, however, cannot be left to be mentioned here to their credit that, in spite of the absence of a **perfect scale,** our musicians of note have still preserved and protected the ancient plant from total annihilation.

It will be evident from the number of vernacular and English treatises on ' Indian Music ' that are in vogue at present that their writers have staked much ink and labour, also many of their valuable pages of their costly works simply in harping upon the construction and tuning of wires of Indian Veena, Sitar and other stringed instruments, but unfortunately not even one of them has attempted to state by Shruti intervals and vibrations the most crowning item of **the exact notes that are produced by the Shadaja, Madhyama and Panchama wires on the fixed frets of our stringed instruments.** It is a clear proof that these authors hopelessly lacked in sufficient technical knowledge of these notes, otherwise they would have cried halt before laying sacrilegious hands on Sarasvati by advocating the **incomplete scale of 12 Semi-tones** for Indian Music. From the study of this treatise it will be quite evident that there is a **world of difference** between the notes that are actually played daily by our musicians on the stringed instruments and the twelve Semi-tones of the scale of the modern authors. The zealots of the incomplete scale of 12 Semi-tones should well remember that their scale may be suitable to our folk or street music of the lowest order, but it is not at all advisable for the classical artistic music of India. It, therefore, badly needs to be discarded by all the students of Indian music from the very initial stage of their study. **Our Natural Shruti Scale of 22 Tones is the only scale that can purify our melody-modes and raise the status of this noble art in the domain of music.**

Sound is the result of vibrations, which exist in sounding bodies independently of the listener. To a deaf man the vibration exists but the sound does not. Sound is produced in our ears and is therefore subjective, but vibration is objective. The vibrations of the common tonic **Sa** are fixed as 240 per second. The vibrations of all other notes of the scales are calculated from the common tonic **Sa** according to their Shruti values. Although vibrations of notes may not be of any use to the vocalist or instrumentalist in the course of his practical demonstrations, theoretically they are of vital importance for determining the **perfect samvadi (concordant) relationship of all the notes of the Raga-scales.** In absence of vibrations modern scholars have adopted a very fictitious method of picking out the **Vadi** (prime) and its **Samvadi** swara (consonant) simply from the **prominence** of certain notes in a Raga according to their own personal choice and whims; consequently this **imaginary** procedure has obviouly resulted in inconsistency and inaccuracy of the Vadi and Samvadi swaras of many Ragas as will be seen from the study of this treatise.

It is also erroneous and misguiding to say that the **fourth** and the **fifth** always stand in samvadi relationship with the Vadi note. This rule of consonance can not be applied to our scale of 22 Tones which comprises some **sharpened** notes also. For instance, a Sankirna Trishrutik (of 20 cents more than three shrutis) $455\frac{1}{9}$ Nishada swara, although it is the fifth of Gandhara swara, can not be in samvadi relationship with 300 Trishrutik Gandhara swara. The fifth samvadi swara of 300 Trishrutik **Ga** is always $300 \times \frac{3}{2} = 450$ Trishrutik **Ni.** Similarly although Dhaivata swara is the fourth of Gandhara swara, there can not be samvadi relationship between 300 Trishrutik **Ga** and 405 Chatushrutik **Dha.** The fourth samvadi swara of 300 Trishrutik **Ga** is always $300 \times \frac{4}{3} = 400$ Trishrutik Dha. Now we will take the instance of 256 Dwishrutik (of two shrutis, popularly known as Komal) Ri. The fourth samvadi swara of 256 Dwishrutik Ri is always $256 \times \frac{4}{3} = 341\frac{1}{3}$ Sankirna Chatushrutik (of 20 cents more than four shrutis) Ma. Now *Madhyama swara is neither the fourth nor the fifth of Rishabha* swara. It is the **third** note from Rishabha. Many more such instances can be quoted, but space does not allow us to add any more here. It must suffice to state that the modern authors' established rule of the fourth and the fifth note from the Vadi being always Samvadi is **simply indiscreet and misleading.**

It should be well remembered that, besides the **prominence** of any two notes in a Raga, the Vadi and its Samvadi note strictly demand a **consonant interval** of $\frac{3}{2}$ (2 : 3) or $\frac{4}{3}$ (3 : 4) between them according to our traditional Shastric rule of Panchama-Bhava Samvad of 13 Shrutis and Madhyama-Bhava Samvad of 9 Shrutis. This consonant interval can be determined only from the **vibrations** of the notes calculated from the tonic 240 **Sa** according to their Shruti values.

From the above it will, therefore, be as clear as noon-day that the **Shruti intervals and vibrations play a most important part in determining the accurate pitch and samvadi relationship of all the notes of the Raga-scales. Notes without Shruti intervals and vibrations have no technical value whatever in music.**

' **Notes** ' are the very foundation of music. If the foundtion itself is weak, the structure is bound to collapse. It is, therefore, the prime duty of all the students of Indian music to have a genuine theoretical knowledge of the Shruti intervals and vibrations of all the Raga notes, they are singing or playing on the instruments, for attaining the highest perfection in the art. **Remember, New India wants real well-cultured artists and not mere machine-like mechanics. Bear well in mind also that ' Science and Art always go hand in hand. '**

Some Distinguishing Features of the Shrutis of Indian Scale

(1) The ' **Shruti** ' is the smallest perceptible difference of pitch.

(2) The number of Shrutis, all differing in pitch, is theoretically infinite and practically very large. Out of them, **only those Shrutis, that are actually sung and played in all the modern Ragas, are taken into consideration, discarding the rest.**

(3) The Shrutis are **unequal** in size, namely of 20, 22 and 70 cents respectively. In other words **the Shruti is not a fixed unit,** as erroneously stated by some modern authors. Should the Shruti be **equal** in size, the **Natural** character of the Scale-notes will be sadly affected. The living proof of this is the Western artificial scale of ' **Equal Temperament.** '

(4) The octave of the Indian scale is conceived as the the sum-total of 22 such Shrutis of unequal size. This has remained the accepted number ever since.

(5) These twenty-two Shrutis have mathematical values and are conversant with the latest theory of musical sounds and ratios.

(6) The twenty-two Shrutis form the foundation of the Natural and Chromatic intervals, and the fountain-head of all the Ragas which owe their origin to the different permutations of the intervals.

(7) All the twenty-two Shrutis are capable of being used as ' **swaras** ' (notes) in various Ragas. Shrutis, actually used in the Raga, become **swaras** for that Raga, while those, not so used, remain **shrutis** only.

(8) The afore-said three Shruti intervals of 20, 22 and 70 cents as such remain only theoretical. They are actually sung only as increments of other larger intervals. There is no case in any Raga where two swaras are separated by any of the afore-said Shruti intervals.

(9) Two consecutive Shrutis, separated by the smallest interval of **20 cents**, are always counted as **one Shruti** and also assume only **one Shruti--name** according to the traditional shastric rule of ' **Shruti Sadharana Prakar.** ' Full details are given in the next chapter.

Shruti Sadharana Prakar

To explain more fully the chapter of '**Shruti Sadharana Prakar**' of our ancient shastra-writers we will take the instance of an interval of four Shrutis (Whole Tone) from the tonic 240 **Sa**.

In the diatonic scale there are three kinds of interval, namely of two, three and four Shrutis having the fractional ratios of $\frac{16}{15}$ (112 cents, Semi Tone), $\frac{10}{9}$ (182 cents, Minor Tone) and $\frac{9}{8}$ (204 cents, Whole Tone) respectively. According to these three diatonic intervals the following three notes can be had from the tonic 240 **Sa**:–

$240 \times \frac{16}{15} = 256$ Dwishrutik (Semi Tone) $\underline{\text{Ri}}$ on the second Shruti.

$240 \times \frac{10}{9} = 266\frac{2}{3}$ Trishrutik (Minor Tone) Ri on the third Shruti.

$240 \times \frac{9}{8} = 270$ Chatushrutik (Whole Tone) **Ri** on the fourth Shruti.

The above three notes from the tonic 240 **Sa** can be arranged on their respective Shrutis as under:—

Notes —	**Sa**,	(Ri),	$\underline{\text{Ri}}$,	Ri,	**Ri**,
Shruti Nos. —		1	2	3	4
Vibrations —	240,		256,	$260\frac{2}{3}$,	270.

Frac: Ratios — $\frac{16}{15} \times \frac{25}{24} \times \frac{81}{80} = \frac{9}{8}$

Cents — $112 + \underbrace{70 + 22}_{92} = 204$

A glance at the above illustration will show that the interval between 240 **Sa** and 256 $\underline{\text{Ri}}$ is Dwishrutik ($\frac{16}{15}$ i. e. 112 cents), while that between 256 $\underline{\text{Ri}}$ and 270 **Ri** is Laghu Dwishrutik ($\frac{25}{24} \times \frac{81}{80} = \frac{135}{128}$ i. e. 92 cents). It will, therefore, be evident that in an interval of four Shrutis the two Dwishruti intervals

are not equal in size. One is **Dwishrutik** (112 cents), while the other is **Laghu Dwishrutik** (92 cents), i. e. less (112–92) **20 cents** than the Dwishruti interval, **although this Laghu Dwishruti interval is also counted as 'two' Shrutis like the Dwishruti interval.** As both the Dwishruti ($\frac{16}{15}$) and the Laghu Dwishruti ($\frac{135}{128}$) intervals are counted **alike as 'two' Shrutis**, the difference of 20 **cents** between them is **'Sadharana'** i. e. ***common to both,*** as will clearly be seen later on.

Now counting in a reverse way from the Chatushrutik 270 **Ri**, the following three notes can be had according to the three diatonic intervals:—

$270 \div \frac{16}{15} = 253\frac{1}{8}$ Laghu Dwishrutik (Soft Semi-tone) $\underline{\underline{\text{Ri}}}$ on the second Shruti from 270 **Ri** or from the tonic 240 **Sa.**

$270 \div \frac{10}{9} = 243$ $\underline{\underline{\text{Ri}}}$ on the third Shruti from 270 **Ri** or on the **first** Shruti from the tonic 240 **Sa.** (This 243 $\underline{\underline{\text{Ri}}}$, being at a '**Shruti interval,**' cannot be used as a '**swara**' (note) with the tonic 240 **Sa**).

$270 \div \frac{9}{8} = 240$ Tonic **Sa** on the fourth Shruti from 270 **Ri.**

The above three notes can be arranged on their respective Shrutis from the tonic 240 **Sa** as under:—

Notes— **Sa,** $\underline{\underline{\text{Ri}}}$, $\underline{\underline{\text{Ri}}}$, Ri, **Ri.**
Shruti Nos.— 1 2 3 4
Vibrations— 240, 243, $253\frac{1}{8}$, $266\frac{2}{3}$, 270.
Frac: Ratios— $\frac{81}{80} \times \frac{25}{24} \times \frac{256}{243} \times \frac{81}{80} = \frac{9}{8}$.
Cents— $\underbrace{22 + 70}_{92} + \underbrace{90 + 22}_{112} = 204$.

A glance at both the above illustrations will show that the **Second Shruti** is '**Sadharana**' i. e. **Common** to both the 256

Dwishrutik (Komal, Semi Sone) Ri and $253\frac{1}{8}$ Laghu Dwishrutik (Ati Komal, Soft Semi Tone) Ri. This kind of two Shrutis was called ' **Shruti Sadharana**' by our ancient Shatra-writers.

The interval between 256 Ri and $253\frac{1}{8}$ Ri is $256 \div 253\frac{1}{8} = \frac{2048}{2025}$ i. e. 20 cents. It is, therefore, an accepted rule in Indian music that **two consecutive Shrutis, separated from each other by an interval of 20 cents, are always counted as ' one ' Shruti and also assume only ' one ' Shruti-name according to our traditional Shastric rule of 'Shruti Sadharana Prakar.'** The note on the second Shruti is the '**Sankirna**' i.e. **augmented** or **sharpened** note of that on the first Shruti. In the above illustrations 256 Dwishrutik Ri is the **sharpened** note of $253\frac{1}{8}$ Laghu Dwishrutik Ri. Both the notes are counted **alike as ' two ' Shrutis** from the tonic 240 **Sa** and also assume only **' one ' Shruti-name**, namely the **second Kumudvati Shruti**, thus

Notes—	**Sa**,	Ri,	Ri,	Ri,	Ri,	**Ri**.
Shruti Nos.—		1	2	2	3	4
Vibrations—	240,	243,	$253\frac{1}{8}$,	256,	$266\frac{2}{3}$,	270.

$$\text{Frac: Ratios—}\quad \frac{81}{80} \times \frac{25}{24} \times \frac{2048}{2025} \times \frac{25}{24} \times \frac{81}{80} = \frac{9}{8}.$$

$$\text{Cents—}\quad \underbrace{22 + 70}_{92} + 20 + \underbrace{70 + 22}_{92} = 204.$$

A glance at the above illustration will clearly show that the interval of **20 cents** is '**Sadharana**' i. e. **common** to both the intermediate 256 Dwishrutik Ri (from 240 **Sa**) and $253\frac{1}{8}$ Laghu Dwishrutik Ri (from 270 **Ri**) as stated above.

It will further be seen that the Shruti intervals are **unequal in size**, namely of 20, 22 and 70 cents respectively. This goes to prove without any doubt that **'the Shruti is not a fixed unit.'**

Supposing the length of the speaking wire to be 36 inches, the location of all the notes (less 243 $\underline{\underline{\text{Ri}}}$ which is not used in our Ragas) will be as under:—

Notes—	**Sa,**	$\underline{\underline{\text{Ri}}}$,	$\underline{\text{Ri}}$,	Ri,	**Ri.**
Shruti Nos.—		2	2	3	4.
Vibrations—	240,	$253\frac{1}{3}$,	256,	$266\frac{2}{3}$,	270.
Vibrating length of the wire from the bridge.—	36,	$34\frac{2}{15}$,	$33\frac{3}{4}$,	$32\frac{2}{5}$,	32.

A complete chart of the location of all the 22 Notes of our Natural Scale on the speaking wire is given on page 48.

Suffice it to say that the Shruti of a **Sankirna (sharpened) note** is always counted as, and also assume the name of the Shruti of its **prime note.** There is always a difference of **20 cents** between these two Shrutis. To have a separate number and name for the Shrutis there must always be a minimum interval of at least **22 cents** between them.

☞ This rule of '**Shruti Sadharana**' requires to be thoroughly borne in mind by all the students of Indian music. Fuller details will be found in the body of the work.

The following are the five **sharpened** notes in our Natural Scale of 22 Tones:—

256 $\underline{\text{Ri}}$, $303\frac{1}{27}$ S-Ga, $341\frac{1}{3}$ S-Ma, 384 $\underline{\text{Dha}}$ and $455\frac{1}{9}$ S-Ni.

As the chapter of '**Shruti Sadharana Prakar**' of our ancient Shastra-writers was unintelligible to the modern authors, they have erroneously counted separate shrutis for the above sharpened notes, thus increasing the number of shrutis to more than **twenty-two** in the octave. I would, therefore, advise my readers to be beware of such **misleading literature.**

Fundamental Modes (Thatas थाटें) *of Indian Music,*

evolved out of the Traditional Murchanas.

(1) Janak Thata 'Kedar' and its 5 Janya Thatas.

(Scale of Veena, Sitar, etc., on Ma-wire from the seventh fret.)

Kedara —	**Sa,**	**Ri,**	**Ga,**	**Ma,**	S-Ma,	**Pa,**	Dha,	Ni,	S-Ni,	**Ṡa.**
		4	7	9	11	13	16	18	20	22
	240,	270,	300,	320,	$341\frac{1}{3}$,	360,	400,	$426\frac{2}{3}$,	$455\frac{1}{9}$,	480
Shuddha Kalyan –	240,	270,	300,	320,	$341\frac{1}{3}$,	360,	400,	0,	$455\frac{1}{9}$,	480
Yaman —	240,	270,	300,	0,	$341\frac{1}{3}$,	360,	400,	0,	$455\frac{1}{9}$,	480
Khamaja —	240,	270,	300,	320,	0,	360,	400,	$426\frac{2}{3}$,	$455\frac{1}{9}$,	480
Shuddha Bilaval –	240,	270,	300,	320,	0,	360,	400,	0,	$455\frac{1}{9}$,	480
Kambhoji –	240,	270,	300,	320,	0,	360,	400,	$426\frac{2}{3}$,	0,	480

50 Ragas are grouped under the above Six Thatas.

(2) Thata 'Bihaga.'

(Modern fundamental scale i. e. the scale of **Sa**-wire from the 'mairu' (nut) including $341\frac{1}{3}$ S-Ma.)

Sa,	**Ri,**	**Ga,**	**Ma,**	S-Ma,	**Pa,**	**Dha,**	**Ni,**	**Ṡa.**
	4	7	9	11	13	17	20	22
240,	270,	300,	320,	$341\frac{1}{3}$,	360,	405,	450,	480

2 Ragas are grouped under this Thata.

(3) Rag 'Deshkar.'

Sa,	Ri,	**Ga,**	**Pa,**	Dha,	**Ṡa.**
	3	7	13	16	22
240,	$266\frac{2}{3}$,	300,	360,	400,	480

(4) Raga ' Bageshri. '

(Bharata's fundamental Scale)

Sa,	3 Ri,	2 $\underline{\underline{\text{Ga}}}$,	4 $\underline{\text{Ma}}$,	4 Pa,	3 Dha,	2 $\underline{\underline{\text{Ni}}}$,	4 Ṡa.
	3	5	9	13	16	18	22
240,	266⅔,	281¼,	320,	360,	400,	426⅔,	480

(5) Janak Thata 'Sindh Bhairavi' and its 2 Janya Thatas.

	Sa,	$\underline{\text{Ri}}$,	**Ri,**	$\underline{\text{Ga}}$,	**$\underline{\text{Ma}}$,**	**Pa,**	$\underline{\text{Dha}}$,	**Dha,**	$\underline{\text{Ni}}$,	**Ṡa**
Sindh Bhairavi		2	4	6	9	13	15	17	19	22
	240,	256,	270,	288,	320,	360,	384,	405,	432,	480
Shuddha Bhairavi	240,	256,	0,	288,	320,	360,	384,	0,	432,	480
Darbari —	240,	0,	270,	288,	320,	360,	384,	0,	432,	480

9 Ragas are grouped under the above 3 Thatas.

(6) Thata ' Multani. '

Sa,	$\underline{\text{Ri}}$,	$\underline{\text{Ga}}$,	S-Ma,	**Pa,**	$\underline{\text{Dha}}$,	S-Ni,	**Ṡa.**
	2	6	11	13	15	20	22
240,	256,	288,	341⅓,	360,	384,	455 1/9,	480

2 Ragas are grouped under this Thata.

(7) Janak Thata ' Sindh Kafi ' and its 2 Janya Thatas.

	-Sa,	**Ri,**	$\underline{\text{Ga}}$,	S-Ga,	**$\underline{\text{Ma}}$,**	**Pa,**	**Dha,**	$\underline{\text{Ni}}$,	S-Ni,	**Ṡa.**
Sindh Kafi		4	6	7	9	13	17	19	20	22
	240,	270,	288,	303 11/27,	320,	360,	405,	432,	455 1/9,	480
Shudd-ahKafi	240,	270,	288,	0,	320,	360,	405,	432,	0,	480
Kanada-	240,	270,	288,	0,	320,	360,	405,	432,	455 1/9,	480

43 Ragas are grouped under the above 3 Thatas.

(8) Thata ' Asavari. '

Sa,	Ri,	$\underline{\underline{\text{Ga}}}$,	$\underline{\text{Ma}}$,	Pa,	$\underline{\underline{\text{Dha}}}$,	$\underline{\underline{\text{Ni}}}$,	$\dot{\text{Sa}}$.
	4	5	9	13	14	18	22
240,	270,	$284\frac{4}{5}$,	320,	360,	$379\frac{7}{27}$,	$426\frac{2}{3}$,	480

4 Ragas are grouped under this Thata.

(9) Thata ' Toadi. '

	Sa,	$\underline{\underline{\text{Ri}}}$,	$\underline{\underline{\text{Ga}}}$,	$\underline{\text{Ma}}$,	S-Ma,	Pa,	$\underline{\underline{\text{Dha}}}$,	$\underline{\underline{\text{Ni}}}$,	S-Ni,	$\dot{\text{Sa}}$.
		1	6	9	11	13	14	18	20	22
	240,	$252\frac{68}{81}$,	$284\frac{4}{5}$,	320,	$341\frac{1}{3}$,	360,	$379\frac{7}{27}$,	$426\frac{2}{3}$,	$455\frac{1}{5}$,	480
Lachari Toadi	240,	$252\frac{68}{81}$,	$284\frac{4}{5}$,	320,	0,	360,	$379\frac{7}{27}$,	$426\frac{2}{3}$,	$455\frac{1}{5}$,	480
Shuddha Toadi	240,	$252\frac{68}{81}$,	$284\frac{4}{5}$,	0,	$341\frac{1}{3}$,	360,	$379\frac{7}{27}$,	0,	$455\frac{1}{5}$,	480
Bilaskhani Toadi	240,	$252\frac{68}{81}$,	$284\frac{4}{5}$,	320,	0,	360,	$379\frac{7}{27}$,	$426\frac{2}{3}$,	0,	480
Rampur-Mat Piloo	240,	$252\frac{68}{81}$,	$284\frac{4}{5}$,	320,	0,	360,	$379\frac{7}{27}$,	0,	$455\frac{1}{5}$,	480

11 Ragas are grouped under the above 4 Thatas.

(10) Janak Thata ' Basant ' and its 4 Janya Thatas.

	Sa,	$\underline{\text{Ri}}$,	Ga,	$\underline{\text{Ma}}$,	S-Ma,	Pa,	$\underline{\text{Dha}}$,	Dha,	Ni,	$\dot{\text{Sa}}$.
Basant—		2	7	9	11	13	15	16	20	22
	240,	256,	300,	320,	$341\frac{1}{3}$,	360,	384,	400,	450,	480
Purvi —	240,	256,	300,	320,	$341\frac{1}{3}$,	360,	384,	0,	450,	480
Shree —	240,	256,	300,	0,	$341\frac{1}{3}$,	360,	384,	0,	450,	480
Panchama-	240,	256,	300,	320,	$341\frac{1}{3}$,	360,	0,	400,	450,	480
Purva Kalyana	240,	256,	300,	0,	$341\frac{1}{3}$,	360,	0,	400,	450,	480

30 Ragas are grouped under the above 5 Thatas.

(11) Thatas of the Ragas sung during Sunrise.

Ramkali — **Sa**, $\underline{\underline{\text{Ri}}}$, **Ga**, $\underline{\textbf{Ma}}$, S-Ma, **Pa**, $\underline{\underline{\text{Dha}}}$, $\underline{\underline{\text{Ni}}}$, **Ni**, $\dot{\textbf{Sa}}$.
2 7 9 11 13 15 18 20 22
240, $253\frac{1}{8}$, 300, 320, $337\frac{1}{2}$, 360, $379\frac{11}{16}$, $426\frac{2}{3}$, 450, 480
Bhairava-240, $253\frac{1}{8}$, 300, 320, 0, 360, $379\frac{11}{16}$, $426\frac{2}{3}$, 450, 480

11 Ragas are grouped under the above 2 Thatas.

Thata 'Anand Bhairava.'

Sa, $\underline{\underline{\text{Ri}}}$, **Ga**, $\underline{\textbf{Ma}}$, **Pa**, Dha, $\underline{\underline{\text{Ni}}}$, **Ni**, $\dot{\textbf{Sa}}$.
2 7 9 13 16 18 20 22
240, $253\frac{1}{8}$, 300, 320, 360, 400, $426\frac{2}{3}$, 450, 480

2 Ragas are grouped under this Thata.

Raga 'Sourashtra.'

Sa, $\underline{\underline{\text{Ri}}}$, **Ga**, $\underline{\textbf{Ma}}$, **Pa**, $\underline{\underline{\text{Dha}}}$, Dhạ, **Ni**, $\dot{\textbf{Sa}}$.
2 7 9 13 15 16 20 22
240, $253\frac{1}{8}$, 300, 320, 360, $379\frac{11}{16}$, 400, 450, 480

In all about 170 prevalent Ragas are grouped under the above 11 Thatas evolved out of the traditional Murchanas. It is the proper **scientific classification** of all the modern Ragas according to our old Shastric **Murchana System**. Full details of the eleven Murchanas with a complete chart of Raga-classification is given in this treatise.

☞ **Remember**

'Murchanas' are the bases of all Indian Raga Melodies. Accurate Raga-Scales, therefore, demand a deep study of the traditional Murchanas as well as a thorough genuine **practical** knowledge of all the notes, that are produced on the stringed instruments, of various Ragas. Raga-scales of the modern authors, being based purely on their **fancies** and on their **incomplete scale** of 12 Semi-tones, are simply erroneous and misleading to the students of Indian music. Their fallacy is clearly exposed in this treatise by solid facts and figures.

Bharata-Natya-Shastra ' & ' Sangeet-Ratnakar '

Indian music naturally falls into two divisions, namely **Grantha Sangeet** ' (i. e. the music systems expounded in our ancient Sanskrit treatises) and ' **Adhunik Sangeet** ' (i. e. the music that is sung and played to-day).

It can not be denied that with the advent of the Mahommedan regime in India a material alteration took place in the outlook of music represented by the old Sanskrit granthas. It is also true that we are now nearly two centuries ahead of the end of the Mahommedan period and that during this long interval our music has undergone still more important changes. Though there may be, and are changes in the music as it is now, from what it was then, there is no such fundamental alteration in it as to make the modern music an essentially different thing. Though the external appearance of modern music has to some extent changed, yet the frame-work appears the same. The substratum of the modern music is undoubtedly the music of the past, and that being so, a study of the past music is most essential. *It is, therefore, necessary to consider* the systems adopted by our old shastra-writers in order to construct a good workable system for our mordern music.

Shrutis, Swaras, Gramas and Murchanas of our ancient musical authorities play a most important part in vocal as well as instrumental music. In fact, they form the basis of all Indian Raga-melodies. I, therefore, propose to restrict my observations to them only, and clearly show how they are applicable *to our modern music also.*

The number of treatises on Indian music, *which are still* extant, will go over a hundred, and these lie scattered all over the country. But the greatest of ancient musical authorities, and who still inspire reverence in the minds of Indian musicians are Bharata and Sarangdeva. The oldest detailed exposition of Indian musical theory is found in **'Bharata--Natya—Shastra'** composed by the sage Bharata in the early part of the sixth century A. D., and in **'Sangeet—Ratnakar'** composed by Sarangdeva about the middle of the thirteenth century A. D..

There is only one chapter of the 'Bharata-Natya-Shastra' (ch. 25) which deals with music proper. This contains a detailed exposition of Shrutis, Swaras, Gramas, Murchanas, etc.. The principles of his theory are still active in Indian music. The Shruti-swara arrangement of 'Sangeet-Ratnakar' of Sarangdeva is essentially the same as that expounded in 'Natya-Shastra' of the sage Bharata. These two treatises throw a considerable light on the music that we sing and play to-day. Bharata has very lucidly explained his Shrutis and Swaras on P. 28 of his work, hence it will be interesting to go through his explanation. If we are able to arrive at any satisfactory conclusions as regards his Shrutis and Swaras, it would hardly be necessary to investigate the Shrutis and Swaras of Sarangdeva.

While interpreting their ancient Sanskrit texts I have rigidly adhered to their directions as a guide for interpretation **without any assumptions whatsoever on my part**, nor have I taken as a guide what subsequent writers have said on the subject.

I have definitely proved in this treatise that the Shruti-scale of our modern music is **the same** as that expounded by Bharata in the early part of the sixth century A. D.. Moreover I have classified all the modern 170 Ragas under **11 Murchanas** according to the traditional Murchana system, with their respective Thatas, Shruti intervals and vibrations of their notes, their accurate Vadi and samvadi notes, etc.. **It is absolutely an**

original research work—the fruit of years of stupendous labour and a very deep study of both the **theoretical** as well as **practical** music. It is not a simple task to gather all the scattered and disconnected facts on the subject and link them up into a system that would make the subject both easy and interesting to learn, *thus putting the art again on a sound footing and protecting* it from further decay.

Besides the above, this treatise contains innumerable items of importance worth studying by all the students of Indian music for attaining a thorough genuine knowledge of and the highest perfection in the art. All the items are so elaborately explained by substantial proofs and accurate mathematical figures *that there will be no room left for any adverse criticism by* the musical intelligentsia.

There are a number of vernacular and English treatises on Indian music, written by some past and present scholars, at present in vogue. These treatises simply attempt a comparatively *exhaustive survey of the past legends and history of* Indian music, theories (all imaginary) on the traditional Shrutis, Swaras, Gramas and Murchanas, biography and various Shruti-Scales (of no practical use) of some past writers, interesting stories of the extraordinary vocal and instrumental feats of some past musicians and such other matters, too numerous to mention here in this small space, quite irrelevant to and of no earthly use for the genuine study of the art. A good and useful literature for the propagation of **sound theoretical and practical knowledge of the art** was *really a desideratum*, hence *the author* sincerely hopes that this treatise will supply the long-needed deficiency.

This English treatise is a reproduction (with some necessary additions) of my Hindi theory books. It is published specially for the benefit of those not conversant with the Hindi language. It is useful alike to the students of both the Northern (Hindustani) and the Southern (Carnatic) schools.

Distinguished as the Hindustani and the Carnatic school, both are yet based on the principles stated in the old Sanskrit treatises on music. There is **one** Indian music, though there are different ways of working it out.

☞ Beware of Misleading Literature at present in vogue.

Before concluding, it will not be out of place to remark here (with due deference to the views expressed by Indian and some enthusiastic Western Scholars) that the existing controversy as regards the traditional Shruti, Swaras, Gramas and Murchanas is mainly due to wrong conclusions drawn from incorrect interpretations and to false theories based on barren conjectures and surmises of some past and present writers, to whom the principles stated in ' Bharata–Natya–Shastra ' and ' Sangeet–Ratnakar ' were absolutely a **' terra incognita.'** From the study of this treatise the readers will be fully convinced that their interpretations and theories are all purely built on *sand. The consequences, therefore, of such wrong conclusions* based on wrong data, are simply disastrous. They have done incalculable and irreparable harm instead of any good to the cause of our most ancient and noble heritage of India. The fallacy of all their fanciful theories, their incomplete scale of 12 Semi–tones, their imaginary Raga–Scales, etc., etc., is fully exposed and proved in this treatise as plainly as that twice two are four. The unhappy part of it is that, by giving publicity to their wrong interpretations and false theories, uncultivated students have been misled into accepting them at their face value and their ' facts ' without verification. I, therefore, conceive it to be the bounden duty of every student to be beware of such existing **misleading literature.**

Glossary of Indian Musical Terms

A

Antar–Interval.

Anuvadi swara–Assonant.

Arohi–Ascending scale.

Atikomal swara—Soft Semi-tone.

Avarohi–Descending scale.

Avikrit or **Achal**–Stationary.

C

Chatushrutik swara–Note of four Shrutis i. e. Whole Tone.

Chute or **Laghu Pa**–The fifth note of 3 Shrutis of the traditional Ma-Grama scale.

D

Dha (**Dhaivata**) – The sixth note of the fundamental scale.

Dwishrutik swara–Note of two Shrutis i. e. Semi-tone.

G

Ga (**Gandhara**) — the third note of the fundamental scale.

Ghoadi–Bridge of the stringed instruments.

Gramas–Fundamental scales.

J

Janak–Primary or Parental.

Janya–Derivative or Secondary.

Joada wire- wire of the note **Sa.**

K

Komal swara- Semi-tone.

L

Laghu Dwishrutik swara—Soft Semi-tone.

Laghu Pa- (see Chute **Pa**).

M

Ma(**Madhyama**)-the fourth note of the fundamental scale.

Madhyama-Bhava Samvadi Swara–the fourth consonant.

Madhya Saptaka–Middle octave.

Mairu–Nut or ledge of the stringed instruments.

Mandra Saptaka—Lower octave.

Murchanas—Melody-bases, Raga scales.

N

Ni (**Nishada**)—the seventh note of the fundamental scale.

P

Pa (**Panchama**) -the fifth note of the fundamental scale.

Panchama-Bhava Smavadi swara—the fifth consonant.

Praman Shruti—Comma of Didymus.

R

Raga—Basis of melody.

Ri (**Rishabha**)-the second note of the fundamental scale.

S

Sa (**Shadaja**)-The first note of the fundamental scale, which is recognized as a common tonic.

Samvaditva---Consonance.

Samvadi swaras-the fourth and the fifth consonants.

Sangeet-Music.

Sankirna-Sharpened or Augmented.

Saptaka-All the notes from the tonic **Sa** to its octave above.

Shruti---Smallest perceptible difference of pitch.

Shuddha Swaras---Seven Natural notes of the fundamental scale.

Swara-Musical sound, Note.

Swarantar---Interval of a Note.

T

Tara Saptaka-Higher octave.

Thatas or **Melas**-Scales under which Ragas are grouped.

✓ **Tivra swara**-Minor Tone.

✓ **Tivratar swara**-Whole or Major Tone.

Trishrutik swara-Note of 3 Shrutis i. e. Minor Tone.

V

Vadi swara - Sonant, Prime Note of a Raga.

Vikrit swara—Chromatic Note.

Vivadi swara-Dissonant Note.

Some Corrections and Additions in Parts I & II

Page	Incorrect	Correct
24	This lowering of the Panchama, etc , etc....is the ' Measure of a Shruti.'	Shruti is **not** the unit of measurement.
27	Tivratar Ma	Sankirna Tivratar Ma
38	$\underline{\text{Ga}}$ 5 $284\frac{4}{5}$	$\underline{\underline{\text{Ga}}}$ 5 $284\frac{1}{5}$
40	180 + 20 = 202 Cents	182 + 20 = 202 Cents,
60	Ni 432	$\underline{\text{Ni}}$ 432
78	Antar-Sa.	Antar-Ga.

Addition.

28 Notes increase in pitch in the inverse ratio of the length of the wire.

[The End]

TEXT BOOK
ON THE
THEORY & PRACTICE OF INDIAN MUSIC

PART I

CHAPTER I.

MUSIC

The technical word for Music throughout India is **'Sangeet,'** which includes vocal and instrumental music as well as dancing. Being based on the self-sufficiency of the voice, it is primarily vocal in essence, hence the name **'Sangeet'** (**'San'** meaning the best way, and **'Geet'** meaning singing).

SHRUTIS

'Shruti' literally means **"musical sound that is audible."** There are twenty-two sounds in an octave rising one above the other, available in music and known as **Shrutis** or **Heterotones.** Truly speaking there can be infinite number of microtones (small intervals) in an octave, but they had to be discarded owing to their indistinctiveness and unpreciseness in practical artistic performance. The traditional Indian practice is to recognize only twenty-two **Shrutis** in an octave. These twenty-two shrutis are quite **audible** and **practicable,** and are. as it were, **the life and soul of Indian music.** It is they that form the foundation of the Natural and Chromatic intervals, and the fountain head of the various Ragas (melody-bases), which owe their origin to the different permutations of the intervals.

NAMES OF 22 SHRUTIS (Heterotones).

1 Tivra, 2 Kumudvati, 3 Manda, 4 Chandovati, 5 Dayavanti, 6 Rajani, 7 Ratika, 8 Roadhri, 9 Kroadha, 10 Vajrika, 11 Prasarini, 12 Preeti, 13 Marjani, 14 Kshiti, 15 Rakta, 16 Sandipini, 17 Alapini, 18 Madanti, 19 Roahini, 20 Ramia, 21 Ugra, 22 Kshobhini.

SAPTAK (Octave).

'Saptak', a set of seven, takes the place of the word **'Octave'**. **Mandra** (lower) **Saptak**, **Madhya** (middle) **Saptak** and **Tara** (higher) **Saptak** are the three registers or seats of sound. Each register is one octave higher than the preceding one.

SWARAS (Musical Notes).

A **'Swara'** is one of the seven musical notes of the **Saptak**. There is no essential difference between the **Shruti** and the **Swara**. Both are sounds capable of being heard. The distinction between them is something like that which exists between a snake and its coil, or between gold and the ornaments made out of it. All Shrutis are capable of being used as Swaras in various Ragas. Sounds (Shrutis) actually used in the Raga become Swaras for that Raga, while those, not so used, remain Shrutis only. The Swaras of one Raga will again become Shrutis only, when the Raga is changed and a different set of Shrutis is selected as Swaras for the new Raga. The selection is always to be made from the afore-said twenty-two Shrutis into which the scale is divided.

The seven Swaras of the Saptak current to-day throughout the whole of India are in the order of ascent from the note, which has now become the common tonic, as under:—

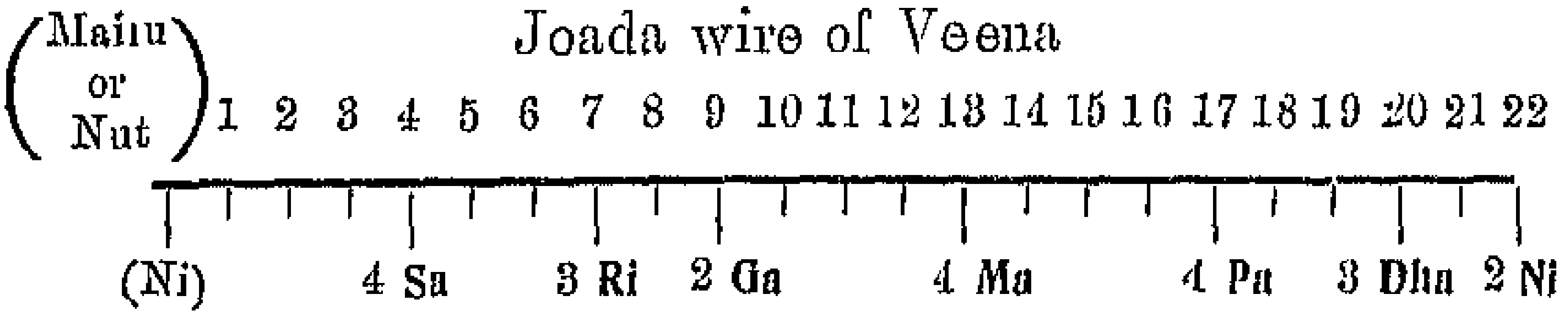
1 **Shadaja**, 2 **Rishabha**, 3 **Gandhara**, 4 **Madhyama**, 5 **Panchama**, 6 **Dhaivata**, 7 **Nishada**.

Their sol-fa initials, also current in every vernacular in India, are as under:—**Sa**, **Ri**, **Ga**, **Ma**, **Pa**, **Dha**, **Ni**.

CHAPTER II.

BHARATA'S SHUDDHA SCALE OF SA-GRAMA.

The following chart will show how Bharata has distributed the seven Shuddha Swaras among twenty-two Shrutis :—



Swaras	—4 **Sa**,	3 **Ri**,	2 **Ga**,	4 **Ma**,	4 **Pa**,	3 **Dha**,	2 **Ni**.
Shruti Nos.—	4	7	9	13	17	20	22

A glance at the above chart will show that the seven Swaras do not stand at an equal distance from each other, but there are three kinds of interval between them, namely of 4, 3 and 2 shrutis. **Sa, Ma** and **Pa** have 4 Shrutis, **Ri** and **Dha** have 3 Shrutis, and **Ga** and **Ni** have two Shrutis. They are called **Chatushrutik Sa, Ma** and **Pa, Trishrutik Ri** and **Dha,** and **Dwishrutik Ga** and **Ni** respectively. The interval of 4 Shrutis is the **Major Tone,** the interval of 3 Shrutis is the **Minor Tone,** and the interval of 2 Shrutis is the **Semi Tone.**

Each Swara becomes manifest on its last Shruti. When the Swaras stand on their proper Shrutis they are called **'Shuddha Swaras'.** The above scale of 4, 3, 2, 4, 4, 3, 2 intervals is called the **'Shuddha Scale of Shadaja (Sa) Grama'.** *See the accompanying chart.*

Chart No. 1.

Bharata's Shuddha Scale of Shadaja Grama.

Number of Shrutis	Names of Shrutis	Names of Swaras
1	Tivra	
2	Kumudvati	
3	Manda	
4	Chandovati	4 **Sa**
5	Dayavanti	
6	Rajjani	
7	Ratika	3 **Ri**
8	Roadhri	
9	Kroadha	2 **Ga**
10	Vajrika	
11	Prasarini	
12	Preeti	
13	Marjani	4 **Ma**
14	Kshiti	
15	Rakta	
16	Sandipini	
17	Alapini	4 **Pa**
18	Madanti	
19	Roahini	
20	Ramya	3 **Dha**
21	Ugra	
22	Kshobhini	2 **Ni**

CHAPTER III.

THE ORIGIN AND DEVELOPMENT OF THE MODERN SCALE.

By co-operation of voice and instrument the scale is worked out, and in one sense the instrument may be called **'The Originator of the Scale'**, because it determines it. To understand easily how the present scale came to be evolved out of the ancient Bharata scale it will be necessary to take the guidance of our popular Vina or Sitar instrument.

In Bharata's time the fundamental or prime tone of the Joada (**Sa**) wire was **Ni**, and from this note the first four Shrutis namely **Tivra, Kumudvati, Manda** and **Chandovati** were counted and the **Shadaja (Sa)** was placed on the fourth **Chandovati Shruti**. In modern music, as every Binkar and Sitarist fully knows, the prime tone of the Joada wire is **Sa**, hence the ancient **Ni** has now become **Sa**. Similarly all the names of the ancient swaras have undergone a change from **Sa** to **Ri**, **Ri** to **Ga**, **Ga** to **Ma** and so on, but **the ancient intervals between the Swaras** 4, 3, 2, 4, 4, 3, 2 **have absolutely remained the same in the present-day music also.** The accompanying chart will clearly show the location of the seven Shuddha Swaras of ancient as well as the modern scale among the twenty-two Shrutis.

NOTE—This matter has been very lucidly explained in "**Bharata-Natya-Shastra**" by the sage Bharata in chapter of "**Sarna-Chatushtayi**".

Chart No. 2.

ANCIENT AS WELL AS MODERN SCALE OF SEVEN SHUDDHA SWARAS OF SA-GRAMA.

	Names of Shrutis.	Ancient names of Swaras.	Modern names of Swaras.
(Mairu)	0 Kshobhini	**Ni**	**Sa**
	1 Tivra		
	2 Kumudvati		
	3 Manda		
	4 Chandovati	4 **Sa**	4 **Ri**
	5 Dayavanti		
	6 Rajjani		
	7 Ratika	3 **Ri**	3 **Ga**
	8 Roadhri		
	9 Krodha	2 **Ga**	2 **Ma**
	10 Vajrika		
	11 Prasarini		
	12 Preeti		
	13 Marjani	4 **Ma**	4 **Pa**
	14 Kshiti		
	15 Rakta		
	16 Sandipini		
	17 Alapini	4 **Pa**	4 **Dha**
	18 Madanti		
	19 Roahini		
	20 Ramya	3 **Dha**	3 **Ni**
	21 Ugra		
	22 Kshobhini	2 **Ni**	2 **Ṡa**

The modern scale evolved out of the ancient Bharata's scale according to the chart will be as under :—

Swaras :—	**Sa,**	4 **Ri,**	3 **Ga,**	2 **Ma,**	4 **Pa,**	4 **Dha,**	3 **Ni,**	2 **Ṡa.**
Shruti Nos. :—		4	7	9	13	17	20	22

This scale of seven Shuddha Swaras is played by all Binkars and Sitarists of the present-day on the Joada (**Sa**) wire from the Mairu (Nut) of the instrument. This clearly proves without any doubt that the scale used by Bharata and Sarangdeva was **the same as the one used by our present-day musicians, and that only the names of the Swaras have undergone a change.**

CHAPTER IV.

GRAMAS (Fundamental scales).

'**Grama**' literally means a group of scales. Indian music is traditionally based on three Gramas namely **Shadaja Grama**, **Madhyama Grama** and **Gandhara Grama**. They are really fundamental scales starting from the notes **Sa**, **Ma** and **Ga** respectively. The '**Natya-Shastra**' gives particulars of two of these, the **Sa-Grama** and the **Ma-Grama**. The **Ga-Grama** is supposed to have passed away into oblivion.

As already stated in Chapter II the Shruti values of the **Sa-Grama** were as follows :—4, 3, 2, 4, 4, 3, 2.

Swaras :—	4 **Sa,**	3 **Ri,**	2 **Ga,**	4 **Ma,**	4 **Pa,**	3 **Dha,**	2 **Ni.**
Shruti Nos. :—	4	7	9	13	17	20	22

The **Ma-Grama** was formed by lowering the Sa-Grama Chatushrutik Pancham by one Shruti, i. e. reducing the value of the Pancham to three Shrutis. The remaining one Shruti of Pancham is now taken over by the succeeding Trishrutik Dhaivata, and consequently the latter, standing on its own proper place or Shruti No. 20, automatically becomes Chatushrutik in the **Ma-Grama**. Thus,

Swaras :—	4 **Sa,**	3 **Ri,**	2 **Ga,**	4 **Ma,**	3 **Pa,**	4 **Dha,**	2 **Ni.**
Shruti Nos. :—	4	7	9	13	16	20	22

In short, by interchanging the Shruti values of **Pa** and **Dha** of **Sa-Grama** we get the **Ma-Grama.**

In the **Ma-Grama** the Pancham is lowered one Shruti. This lowering of the Pancham to obtain the Ma-Grama Pancham, or the rising of the Ma-Grama Pancham by one Shruti to obtain the Sa-Grama Pancham is the **'measure of a Shruti'**. Bharata calls this difference of one Shruti a **'Praman Shruti'** i. e. **'Indicative interval'**, because all the other intervals can be deduced from it.

As a result of the development of instrumental music the very important step of shifting the tonic and reducing all the scales to **one common tonic** was taken, and thus they were transformed into simple instrumental scales. This tonic, which was formerly **Ni**, eventually became **Sa**, and then gradually the term "**Grama**" dropped out.

In Bharata's time the scale of the **Ma-Grama** used to start from the note **Ma.** In modern music **Sa is recognized as a common tonic**, consequently each Raga starts now from the one tonic **Sa**, thus giving rise to the idea that the **Ma-Grama** has entirely disappeared, but it is not so. It is still surviving in many of the Ragas of our modern music.

The relation of the constituent notes of the ancient and the modern scale of the **Ma-Grama** can be represented thus,

(Mainu)
Bharata's Scale—Ni, 4 Sa, 3 Ri, 2 Ga, 4 Ma, 3 Pa, 1 Dha, 2 Ni.
Modern Scale—Sa, 4 Ri, 3 Ga. 2 Ma, 1 Pa, 3 Dha, 4 Ni, 2 Sa.
Shruti Nos.— 4 7 9 13 16 20 22

A glance at the modern scale of the **Ma-Grama** will show that the modern chatushrutik Dhaivata of Sa-Grama is reduced to three shrutis and its one shruti is taken over by the succeeding modern trishrutik **Ni.** Consequently the latter, standing on its own proper place or Shruti No. 20, automatically becomes chatushrutik in the **Ma-Grama.**

CHAPTER V

ANTAR-GANDHARA and KAKLI-NISHADA SWARAS

In the music system expounded in '**Bharata-Natya-Shastra**' there were also two **vikrit swaras** besides the seven shuddha swaras already mentioned. They were named '**Antar-Gandhara**' and '**Kakli-Nishada**'. The words **Antar** and **Kakli** are found describing respectively the sharp shrutis of **Ga** and **Ni**. Out of four shrutis of **Ma** when **Ga** takes two shrutis (**Vajrika** and **Prasarini**) it is called **Antar-Ga.** Similarly out of four shrutis of **Sa** when **Ni** takes two shrutis (**Tivra** and **Kumudvati**) it is called **Kakli-Ni.** In ancient music **Sa** and **Ma**, being Gramadhipati swaras, were '**avikrit**' i. e. they could not under any circumstances take the names of their respective preceding notes, consequently the two vikrit swaras were named after **Ni** and **Ga** respectively. They were thus named after the seven shuddha notes **for convenience only**, though their existence was as independent and important as that of the shuddha notes. Thus it will be seen that in Bharata's time there were in all 9 **swaras** in the octave. The relations of the constituent shuddha and vikrit swaras of Bharata's scale can be represented thus,

Swaras—**Ni, 2K-Ni, 2Sa, 3Ri, 2Ga, 2A-Ga, 2Ma, 4Pa, 3Dha, 2Ni.**
Shruti Nos — 2 4 7 9 11 13 17 20 22

Here a question will naturally be asked why Bharata has made this arrangement of the two vikrit swaras in **Sa** and **Ma** only, leaving aside all the other swaras of the octave. The answer is that this arrangement of the extra swaras can be made only between those two swaras that have an interval of **4 shrutis** between them and not less. It is a fixed rule in music that there cannot be two swaras on shrutis adjoining each other, and that there must be at least one intermediate shruti between any two swaras. The interval of two adjoining shrutis is merely a Shruti or an Enharmonic interval and not a Swara or a Diatonic interval. There is no case in any raga where two swaras are separated by an enharmonic interval, and as such all one shruti intervals remain theoretical only and are actually sung only as increments of other larger intervals.

According to this rule it is not possible to have a vikrit swara between **Sa** and **Ri** having an interval of 3 shrutis. **Ri** is on shruti No. 7. Now to have a vikrit swara we will have to leave one shruti No. 6 and have a vikrit swara on shruti No. 5. But this shruti No. 5 will be close to shruti No. 4 of the swara **Sa**, hence there will be the breach of the above rule. Similarly there cannot be any vikrit swara between **Pa** and **Dha** having an interval of 3 shrutis between them. Interval of two shrutis is itself smaller than an interval of 3 shrutis, hence naturally there cannot be a vikrit swara. It, therefore, goes to prove without any doubt that the vikrit swaras can be had only in the interval of 4 shrutis, i. e. **Sa**, **Ma** and **Pa**. The swara **Pa** has already been reduced to 3 shrutis in the **Ma-Grama**, hence now there remain only two swaras **Sa** and **Ma** having an interval of 4 shrutis. The vikrit swara '**Kakli Nishada**' is placed in the interval of **Sa** and the vikrit swara '**Antar Gandhara**' is placed in the interval of **Ma**.

As the ancient **Ni** is the present-day **Sa** the modern scale of 9 swaras will be as shown in the accompanying chart No. 3. (The location of Kakli Nishada and Antar Gandhara is just the same in scales of both the Grammas.)

Chart No. 3.

THE ANCIENT AND THE MODERN SCALE OF 7 SHUDDHA AND 2 VIKRIT SWARAS.

Names of Shrutis	Ancient Swaras	Modern Swaras
0 Kshobhini	Ni	Sa
1 Tivra		
2 Kumudvati	Kakli-Ni	Komal Ri
3 Manda		
4 Chandovati	Sa	Ri
5 Dayavanti		
6 Rajjani		
7 Ratika	Ri	Ga
8 Roadhri		
9 Krodha	Ga	Komal Ma
10 Vajrika		[illegible]
11 Prasarini	Antar-Ga	Tivratar Ma
12 Preeti		
13 Marjini	Ma	Pa
14 Kshiti		
15 Rakta		
16 Sandipini		
17 Alapini	Pa	Dha
18 Madanti		
19 Roahini		
20 Ramia	Dha	Ni
21 Ugra		
22 Kshobhini	Ni	Ṡa

CHAPTER VI.

LOCATION OF 7 SHUDDHA SWARAS OF THE MODERN SCALE ON THE SOUNDING WIRE OF THE VEENA.

The modern scale of seven shuddha notes may be correctly expressed in terms of the lengths of the speaking wire as follows :—

Notes—	**Sa**,	4**Ri**,	3**Ga**,	2**Ma**,	4**Pa**,	4**Dha**,	3**Ni**,	2**Ṡa**.
Length of wire from the bridge —	36,	32,	$28\frac{4}{5}$,	27,	24,	$21\frac{1}{3}$,	$19\frac{1}{5}$,	18 (inches)
Measure of wire from the bridge —	1	$\frac{8}{9}$	$\frac{4}{5}$	$\frac{3}{4}$	$\frac{2}{3}$	$\frac{16}{27}$	$\frac{8}{15}$	$\frac{1}{2}$

Supposing the whole length of the wire to be 36 inches, **Sa** of the higher octave will be 18 inches (i. e. $36 \div 2$) from either end i. e. exactly in the centre of the wire. Similarly by dividing the length of wire of any note by 2 we get the length of the wire of that note of the higher octave, thus

The length of the wire (from the bridge) of **Ri** of the higher octave will be $32 \div 2 = 16$ inches, **Ga** of the higher octave $28\frac{4}{5} - 2 = 14\frac{2}{5}$ inches and so on.

The placing of the seven shuddha swaras being satisfactorily effected, it is needless to work out the exact places of the vikrit swaras here, as it is a purely mathematical calculation.

By co-operation of voice and instrument the scale is worked out. In one sense the instrument may be called the '**Originator of the Scale**', because it determines it. The location of the swaras on the sounding wire of the Veena is in the interests of those who lack in good knowledge of the swaras.

CHAPTER VII

FRACTIONAL RATIOS OF THE INTERVALS OF 7 SHUDDHA SWARAS OF MODERN SCALE.

As already stated, there are three sorts of interval between the seven shuddha swaras, namely of 4, 3 and 2 shrutis. By dividing the measure of the length of the wire of any swara by that of its succeeding swara we get the fractional ratio of the interval between those two swaras, thus

The interval between **Sa** and **Ri** is of 4 shrutis, hence the fractional ratio of an interval of **4 shrutis** will be $1 \div \frac{8}{9} = \frac{9}{8}$.

The interval between **Ri** and **Ga** is of 3 shrutis, hence the fractional ratio of an interval of **3 shrutis** will be $\frac{8}{9} \div \frac{4}{5} = \frac{10}{9}$.

The interval between **Ga** and **Ma** is of 2 shrutis, hence the fractional ratio of an interval of 2 shrutis will be $\frac{4}{5} \div \frac{3}{4} = \frac{16}{15}$.

The seven shuddha swaras of our modern scale with their fractional ratios can be represented thus,

Swaras—Sa, 4Ri, 3Ga, 2Ma, 4Pa, 4Dha, 3Ni, 2Ṡa.

Fractional Ratios— $\frac{9}{8} \times \frac{10}{9} \times \frac{16}{15} \times \frac{9}{8} \times \frac{9}{8} \times \frac{10}{9} \times \frac{16}{15} = 2$

The multiplication of all the fractional ratios is 2, i. e. **Ṡa** of the higher octave is double in pitch of **Sa** of the middle octave.

CHAPTER VIII

VIBRATIONS OF 7 SHUDDHA SWARAS OF MODERN SCALE.

By multiplying the vibrations of any swara by the fractional ratio of the interval of the succeeding swara we get the vibrations of the latter. Supposing the vibrations of **Sa** to be 240, the vibrations of **Ri** will be $240 \times \frac{9}{8} = 270$, of **Ga** to be $270 \times \frac{10}{9} = 300$ and so on. Thus the vibrations of the seven shuddha swaras of our modern scale will be as follows :—

Swaras— Sa, 4Ri, 3Ga, 2Ma, 4Pa, 4Dha, 3Ni, 2Ṡa.

Fractional Ratios— $\frac{9}{8} \times \frac{10}{9} \times \frac{16}{15} \times \frac{9}{8} \times \frac{9}{8} \times \frac{10}{9} \times \frac{16}{15} = 2$

Vibrations—240, 270, 300, 320, 360, 405, 450, 480.

The vibrations of **Ṡa** of the higher octave is 480 (240×2) i. e. Ṡa of the higher octave is double in pitch of **Sa** of the middle octave. Similarly the vibrations of any swara of the higher octave can be determined by multiplying the vibrations of the swara of the middle octave by 2, thus

270 **Ri** of the middle octave will be 270×2=540 **Ṙi** in the higher octave. Similarly 300 **Ga** of the middle octave will be 300×2=600 **Ġa** in the higher octave, and so on.

Vibrations of any swara in the lower octave can be determined by dividing the vibrations of the swara of the middle octave by 2, thus

240 **Sa** of the middle octave will be 240÷2=120 **Ṣa** in the lower octave. Similarly 270 **Ri** of the middle octave will be 270÷2=135 **Ṛi** in the lower octave, and so on.

The vibrations of the seven shuddha swaras of our modern **Ma-Grama** scale will be as follows :—

Swaras— Sa, 4Ri, 3Ga, 2Ma, 4Pa, 3Dha, 4Ni, 2Ṡa.

Fractional Ratios— $\frac{9}{8} \times \frac{10}{9} \times \frac{16}{15} \times \frac{9}{8} \times \frac{10}{9} \times \frac{9}{8} \times \frac{16}{15} = 2$

Vibrations—240, 270, 300, 320, 360, 400, 450, 480.

In our modern **Sa-Grama** scale the vibrations of the **Chatushrutik Dha** were 405, while in the modern **Ma-Grama** scale the vibrations of the **Trishrutik Dha** are 400. A glance at the seven shuddha swaras and vibrations of the above modern **Ma-Grama** scale will show that **it is identical with the Major Chord of Western music.** This affords the clearest evidence that our musical scientists of pre-ancient days had a profound understanding of the laws of sound in relation to music, and that **our music was highly systematised.**

CHAPTER IX

(Chart No. 4).

Intervals of the Scale of Indian Music.

Interval (Western Name)	Interval (Indian Name)	Shrutis	Fractional Value	Cents
Octave ..	**Saptak-antar** ...	22	2	1200
Consonant (Fifth) ...	**Panchama Bhava Samvad-antar**	13	$\frac{3}{2}$	702
,, (Fourth)...	**Madhyama Bhava Samvad-antar**	9	$\frac{4}{3}$	498
Assonant ...	**Anuvad-antar** ...	7	$\frac{5}{4}$	386
,, ...	,, ...	6	$\frac{6}{5}$	316
Major Tone ...	**Chatushruti-antar**	4	$\frac{9}{8}$	204
Sharp Major Tone..	**Sankirna Chatushruti-antar**	4	$\frac{256}{225}$	224
Minor Tone ...	**Trishruti-antar** ...	3	$\frac{10}{9}$	182
Sharp Minor Tone..	**Sankirna Trishruti-antar**	3	$\frac{4096}{3645}$	202
Semi Tone ..	**Dwishruti-antar...**	2	$\frac{16}{15}$	112
Soft Semi Tone ...	**Laghu Dwishruti-antar**	2	$\frac{135}{128}$	92
Pythagorean Limma	**Sankirna Shruti-antar**	1	$\frac{256}{243}$	90
Enharmonic Interval	**Shruti-antar** ...	1	$\frac{25}{24}$	70
,,	,,	1	$\frac{2048}{2025}$	20
,, **(Comma of Didymus)**	**Praman Shruti** ...	1	$\frac{81}{80}$	22

Note—'**Cents**' are a set of slightly modified logarithms of fractional ratios between 1 and 2, and represent musical intervals within the compass of an octave ($\frac{2}{1}$) correct to the hundreth part of a Semi Tone.

Detailed Explanation of the Various Intervals and their Fractional Ratios.

The possible gradations of the pitch of musical sounds are infinite, but for the purposes of the art certain relative distances of height and lowness have to be definitely determined and maintained. The sounds so chosen are the notes of the system, and the distances between them are the '**Intervals**'. With different objects in view, different intervals between the sounds have been determined on, and various national scales present great diversities in this respect.

The Indian modern fundamental scale of seven swaras with the measure of the length of the speaking wire from the bridge (घोडी) of the instrument can be represented thus,

Shruti Nos.—		4	7	9	13	17	20	22
Modern Swaras—	Sa,	4Ri,	3Ga,	2Ma,	4Pa,	4Dha,	3Ni,	2Ṡa.
Vibrations—	240,	270,	300,	320,	360,	405,	450,	480.
Measure of wire from the bridge —	1	$\frac{8}{9}$	$\frac{4}{5}$	$\frac{3}{4}$	$\frac{2}{3}$	$\frac{16}{27}$	$\frac{8}{15}$	$\frac{1}{2}$

Fractional Ratios— $\frac{9}{8} \times \frac{10}{9} \times \frac{16}{15} \times \frac{9}{8} \times \frac{9}{8} \times \frac{10}{9} \times \frac{16}{15} = 2$

Cents— $204 + 182 + 112 + 204 + 204 + 182 + 112 = 1200$

The measures of the length of the speaking wire play a most important part in determining the fractional ratios of various intervals. The monochord or single string, stretched over a soundboard and measured by moveable bridges, has been the canon of musical intervals, the relative scale of pitch. The string by itself would give but a faint tone in the surrounding air, hence a soundboard is necessary to reinforce the tone, and make it sufficiently audible.

We will now go through the details of the relations between the theoretical magnitudes of the different kinds of tones of our modern scale as given in the chart.

Saptakantar (Interval of an octave)

Saptakantar (octave) is the interval of eight prime tones. It is the most perfect consonance in music, hence it is also called '**Susamvadantar**'. The eighth of the octave is always the response to the first.

There is an interval of twenty-two shrutis between **Sa** and **$\dot{\text{Sa}}$** above. The fractional ratio of the interval of twenty-two shrutis according to the measure of the length of the speaking wire ($1 - \frac{1}{2}$) or the multiplication of the fractional ratios of the eight prime tones in the octave is 2 i. e. 1200 cents. Thus, the ratio of its sounds is 1 : 2 i. e. every note has twice the number of vibrations of its corresponding note an octave lower.

Samvadantar (Harmonic Interval)

Consonance is called 'Samvaditva' in Indian music.

The interval of 13 or 9 shrutis is called '**Samvadantar**'. There is an interval of 13 shrutis between **Sa** and Pa, hence it is called 'Panchama-Bhava Samvadantar'. There is an interval of 9 shrutis between **Sa** and **$\underline{\text{Ma}}$**, hence it is called 'Madhyama-Bhava Samvadantar'.

According to the measure of the length of the speaking wire ($1 \div \frac{2}{3}$) or the multiplication of the fractional ratios of the notes between **Sa** and **Pa**, the fractional ratio of the Panchama-Bhava Samvadantar is $\frac{3}{2}$ i. e. 702 cents. Similarly the fractional ratio of the Madhyama-Bhava Samvadantar is ($1 \div \frac{3}{4}$) $\frac{4}{3}$ i. e. 498 cents.

The interval of 13 shrutis between **Sa** and **Pa** (the fifth), and that of 9 shrutis between **Sa** and **$\underline{\text{Ma}}$** (the fourth) are fixed consonant intervals in our ancient as well as our modern music also. The same intervals are adhered to in music of the whole universe.

As previously stated, an octave is conceived of 22 shrutis. There is an interval of 13 shrutis between **Sa** and **Pa**, consequently the interval between **Pa** and **$\dot{\text{Sa}}$** above will be of 9 shrutis only. Similarly the interval between **Sa** and $\underline{\textbf{Ma}}$ is of 9 shrutis, consequently the interval between $\underline{\textbf{Ma}}$ and $\dot{\textbf{Sa}}$ above will be 13 shrutis, hence the interval of 9 or 13 shrutis is called '**Samvadantar**' having the fractional ratios of $\frac{3}{2}$ and $\frac{4}{3}$ respectively.

A fifth is the perfect consonance, the ratio of the vibrational numbers of the limiting sounds of which is 2:3. It is called fifth because five diatonic notes are passed through in arriving from one extreme of the interval to the other. It is an interval comprising two Major Tones, one Minor Tone and one Semi Tone.

Similarly a fourth is also a perfect consonance, the ratio of the vibrational numbers of the limiting sounds of which is 3:4. It is called fourth because four diatonic notes are passed through in arriving from one extreme of the interval to the other. It is an interval comprising one Major Tone, one Minor Tone and one Semi Tone.

It should be particularly borne in mind that a Sankirna (augmented) fifth or fourth can never be consonants, as they are notes alien to the harmony. This subject is fully explained later on in this treatise.

VADI, SAMVADI, ANUVADI AND VIVADI SWARAS.

Bharata divides swaras into four kinds, and this has remained the accepted division ever since. First there is the **Vadi** (Sounding Note, Sonant). Then the **Samvadi**, the note consonant with the **Vadi**. As aforesaid, swaras having a fractional ratio of $\frac{3}{2}$ or $\frac{4}{3}$ between them are in Samvadi relationship (harmony) with each other. Then there are **Anuvadi** and **Vivadi** swaras, a detailed description of which is given below.

Anuvadi swaras—Swaras that are neutral in relation to the **Vadi** are called '**Anuvadi**' swaras (Assonant). Swaras, having an interval of 7 or 6 shrutis between them, are **Anuvadi swaras**.

Ga, is at an interval of 7 shrutis from **Sa**, hence the fractional ratio according to the measure of the length of the speaking wire ($1 \div \frac{4}{5}$) or the multiplication of the fractional ratios of the notes between **Sa** and **Ga** is $\frac{5}{4}$ i. e. 386 cents.

Pa is at an interval of 6 shrutis from **Ga**, hence the fractional ratio according to the measure of the length of the speaking wire ($\frac{4}{5} \div \frac{2}{3}$) or the multiplication of the fractional ratios of the notes between **Ga** and **Pa** is $\frac{6}{5}$ i. e. 316 cents.

Vivadi swaras—Swaras at an interval of two shrutis from the **Vadi** are called '**Vivadi**' **swaras**, or Dissonant in relation to it, as they are notes alien to the harmony.

The **Vadi** note of a Raga is like the king of the Raga. **Samvadi** is like a minister to the king of the Raga. **Anuvadi,** being neutral, is compared to the secretary. **Vivadi** destroys the beauty of the Raga, and is therefore called the enemy. **Vivadi** swaras are also used in the ragas, but being alien to harmony, they are not given so much prominence like Vadi, Samvadi and Anuvadi swaras.

Note—Those notes, that are totally excluded from any raga, are called '**Varjia (वर्ज)**' swaras and not Vivadi swaras as some authors have stated.

Swarantar (Diatonic Interval)

Bharata calls the intervals of four, three and two shrutis of his scale of 9 Natural Tones in the octave '**Swarantars**'. Their fractional ratios, as previously stated, are $\frac{9}{8}$ i. e. 204 cents, Chatushruti Antar, $\frac{10}{9}$ i. e. 182 cents, Trishruti Antar, and $\frac{16}{15}$ i. e. 112 cents, Dwishruti Antar respectively. As there are 22 tones in the modern scale, Laghu Dwishruti Antar and Sankirna Shruti Antar are also included in the list of Swarantars in modern music. A detailed description of these two intervals is given later on at their proper places.

Laghu Dwishruti Antar (Interval of Soft Semi Tone).

Out of an interval of four shrutis between two prime tones when the intermediate vikrit note takes two shrutis, the value of the remaining two shrutis is always less than two shrutis, hence it is called **'Laghu Dwishruti Antar'** (Diminished, chromatic or soft semitone). Its fractional ratio will be $\frac{9}{8} \div \frac{16}{15} = \frac{135}{128}$ i. e. 204 – 112 = 92 cents, thus

Modern Swaras—	**Sa**, 2 $\underline{\text{Ri}}$, **2Ri.**	**Sa.** 2 $\underline{\underline{\text{Ri}}}$, **2Ri.**
Shruti Nos.—	2 4	2 4
Vibrations—	240, 256, 270	240, $253\frac{1}{8}$, 270
Frac: Ratios—	$\frac{16}{15} \times \frac{135}{128} = \frac{9}{8}$	$\frac{135}{128} \times \frac{16}{15} = \frac{9}{8}$
Cents—	112 + 92 = 204	92 + 112 = 204

According to the first illustration by adding two shrutis to the prime tone 240 **Sa** we get $240 \times \frac{16}{15} = 256$ **Komal** $\underline{\text{Ri}}$. It is a diatonic semitone. Now according to the second illustration by deducting two shrutis from the second prime tone 270 **Ri** we get $270 \div \frac{16}{15} = 253\frac{1}{8}$ **Atikomal** $\underline{\underline{\text{Ri}}}$. It is a chromatic or soft semitone. Both the intermediate Komal and Atikomal Rishabha are alike counted as **two shrutis** from the prime tone 240 **Sa** and both of them assume **one shruti-name** only, namely the second **Kumudvati** shruti, as will be clearly seen from both the above illustrations.

The difference between a Dwishruti Antar and a Laghu Dwishruti Antar will be $\frac{16}{15} \div \frac{135}{128} = \frac{2048}{2025}$ i. e. 112–92=20 cents. It is, therefore, an accepted rule in Indian music that **'shrutis, separated from each other by an interval of 20 cents, are always counted as one shruti and assume one shruti-name only'**. To have a separate name for each shruti there should always be a minimum interval of 22 cents i. e. of Praman Shruti between them. This most ingenious device was adopted by our ancient shastra-writers with a view to minimumise the number of shrutis in the octave.

☞ The aforesaid rule requires to be thoroughly borne in mind by all students of Indian music.

The second Kumudvati shruti is **'satharan'** i. e. common to both 256 **Komal** $\underline{\text{Ri}}$ and $253\frac{1}{8}$ **Atikomal** $\underline{\underline{\text{Ri}}}$. This kind of two shrutis was called **'Shruti Satharan Prakar'** by our ancient shastra-writers.

Note—Some of the past and present scholars, being absolutely ignorant of or not being able to properly understand the '**Satharan Prakarana**' of ancient Sanskrit granthas, count different shrutis for those separated by an interval of 20 *cents, thus increasing the number of shrutis to more* than twenty-two in the octave. The existing controversy and great differences of opinion as regards shrutis and swaras of our ancient sages is purely due to blunders committed by some of the past and present authors, to whom the shruti theory of Bharata and Sarangdeva was a '**terra-in-cognita**'. All sorts of their **imaginary** theories have simply served to misguide the students, thus doing irreparable harm instead of any good to the cause of Indian music. It will not be out of place here to warn my readers against such misleading literature.

Shruti Antar (Enharmonic Intervals)

The enharmonic intervals are such intervals as correspond to a difference of **1** between the shrutis of the swaras, or are the various quotients of the fractions which answer to those swaras. The number 4, 3 and 2 may be handled in different ways so as to produce a difference of 1 thus,

(1) Chatushruti Antar (Major Tone) minus Trishruti Antar (Minor Tone), $\frac{9}{8} \div \frac{10}{9} = \frac{81}{80}$ i. e. $204 - 182 = 22$ cents. This is the '**Praman Shruti**' or the Western '**Comma of Didymus**'. Full details of this Praman Shruti is given in the next chapter.

(2) Trishruti Antar (Minor Tone) minus Dwishruti Antar (Diatonic Semi Tone), $\frac{10}{9} \div \frac{16}{15} = \frac{25}{24}$ i. e. $182 - 112 = 70$ cents.

(3) Dwishruti Antar (Diatonic Semi Tone) minus Laghu Dwishruti Antar (Chromatic, Diminished or Soft Semi Tone), $\frac{16}{15} \div \frac{135}{128} = \frac{2048}{2025}$ i. e. $112 - 92 = 20$ cents. Shrutis separated by this interval are always counted as **one** shruti and assume ***one shruti-name*** only as previously stated.

The aforesaid three enharmonic intervals as such remain only theoretical. They are actually sung only as increments of other larger intervals. There is no case in *any raga where two swaras are separated by any of the* above three enharmonic intervals, as they are merely **Shruti Antars** and not **Swarantars.** It should be particularly borne in mind that only **Swarantars** are used in all raga scales as well as in fixing all the frets on stringed instruments.

From the aforesaid three kinds of enharmonic intervals it will be quite open as day light that the shrutis are not equal in size i. e. **the shruti is not a fixed unit.** The octave is conceived as the sum-total of twenty-two such intervals of different fractional ratios. If all the shrutis be of **equal** size, the natural character of our scale notes will be seriously affected. The living proof of this is the artificial Western Scale of 'Equal Temperament' fixed on key-board instruments.

Sankirna (Sharpened or Augmented) **Intervals.**

When any of the aforesaid intervals of one Shruti Antar, Laghu Dwishruti Antar, Dwishruti Antar, Trishruti Antar and Chatushruti Antar is increased by **20 cents** it becomes a **Sankirna** (augmented) interval. Its shruti **number** and **name** are just the same as its original interval. A detailed description of all the Sankirna intervals, that are used in Indian music, are given below.

(1) **Sankirna Shruti Antar** (Pythagorean Limma).

When a shruti interval of $\frac{25}{24}$ i. e. 70 cents is increased by 20 cents, it is called **'Sankirna Shruti Antar'**, thus,

$\frac{25}{24} \times \frac{2048}{2025} = \frac{256}{243}$ i. e. $70 + 20 = 90$ cents.

	(1) **Shruti Antar.**			(2) **Sankirna Shruti Antar.**		
	3			3		
Modern Swaras—	**Ri,**	$\underline{\underline{\text{Ga}}}$,	**Ga.**	**Ri,**	$\underline{\underline{\text{Ga}}}$,	**Ga.**
Shruti Nos.—	4	5	7	4	5	7
Vibrations—	270,	$281\frac{1}{4}$,	300	270,	$284\frac{4}{9}$,	300
Frac; Ratios—	$\frac{25}{24} \times \frac{16}{15} = \frac{10}{9}$			$\frac{256}{243} \times \frac{135}{128} = \frac{10}{9}$		
Cents—	$70 + 112 = 182$			$90 + 92 = 182$		

In the first illustration there is a Shruti Antar i. e. an enharmonic interval of 70 cents between 270 **Ri** and 281¼ Ga, hence these two swaras cannot occur consecutively (one after the other) in any raga as aforesaid. In the second illustration there is a Sankirna Shruti interval of 90 cents between 270 **Ri** and 284⁴⁄₉ Ga. Although this Sankirna Shruti interval is also counted as **one shruti** only, it being 20 cents more than an enharmonic interval and also there being an intermediate mugdha (मुग्ध) shruti of 281¼ Ga, 270 **Ri** and 284⁴⁄₉ Ga do occur consecutively in our raga melodies. As there is a difference of 20 cents between 284⁴⁄₉ Ga and 281¼ Ga ($284\frac{4}{9} \div 281\frac{1}{4} = \frac{2048}{2025}$ i. e. $90 - 70 = 20$ cents), both these swaras assume **one** shruti name, namely the fifth Dayavanti, as will be seen from both the above illustrations.

It should be borne in mind that in an interval of four shrutis, a Dwishruti Antar and a Laghu Dwishruti Antar (or vice versa) are used as Swarantars, while in an interval of three shrutis a Sankirna Shruti Antar and a Laghu Dwishruti Antar (or vice versa) are used as Swarantars, thus,

2 Swarantars in the interval of four shrutis—$\frac{16}{15} \times \frac{135}{128} = \frac{9}{8}$ i. e. $112 + 92 = 204$ cents.

2 Swarantars in the intervals of three shrutis—$\frac{256}{243} \times \frac{135}{128} = \frac{10}{9}$ i. e. $92 + 90 = 182$ cents.

These swarantars are strictly adhered to in all the raga scales as well as in fixing the frets of all the prime and vikrit (modified) notes on stringed instruments.

Note—Dwishruti Antar minus the Praman Shruti Antar will also produce a difference of **1**, hence it is counted as **one shruti** only, thus,

$\frac{16}{15} \div \frac{81}{80} = \frac{256}{243}$ i. e. $112 - 22 = 90$ cents i. e. Sankirna Shruti Antar (Diminished Soft Semi Tone).

(2) Sankirna Laghu Dwishruti Antar i. e Dwishruti Antar
(Diatonic Semi Tone)

When an interval of Laghu two shrutis ($\frac{135}{128}$) is increased by 20 cents it is called '**Sankirna Laghu Dwishruti Antar**,' thus,

$\frac{135}{128} \times \frac{2048}{2025} = \frac{16}{15}$ i. e. $92 + 20 = 112$ cents.

A Sankirna Laghu Dwishruti Antar (112 cents) is the same as the **Dwishruti Antar.** As previously stated both the Laghu Dwishruti Antar and the Sankirna Laghu Dwishruti Antar i. e. Dwishruti Antar are alike counted as **two** shrutis from the prime tone and assume **one** shruti-name only. The same rule applies to **Sankirna Dwishruti Antar** (Augmented Semi Tones) also.

(3) Sankirna Trishruti Antar (Augmented Minor Tone).

When an interval of three shrutis is increased by 20 cents it is called '**Sankirna Trishruti Antar**,' thus,

$\frac{10}{9} \times \frac{2048}{2025} = \frac{4096}{3645}$ i. e. $18\overset{2}{\cancel{0}} + 20 = 202$ cents.

	(1) Trishruti Antar.			(2) Sankirna Trishruti Antar.		
	3			3		
Modern Swaras—	**Ri,**	$\underline{\underline{\text{Ga}}}$	**Ga.**	**Ri,**	$\underline{\underline{\text{Ga}}}$,	S-Ga.
Shruti Nos —	4	5	7	4	5	7
Vibrations—	270,	$284\frac{4}{9}$,	300	270,	$284\frac{4}{9}$,	$303\frac{11}{27}$
Frac; Ratios—	$\frac{256}{243} \times \frac{135}{128} = \frac{10}{9}$			$\frac{256}{243} \times \frac{16}{15} = \frac{4096}{3645}$		
Cents—	$90 + 92 = 182$			$90 + 112 = 202$		

It will be evident from the above illustrations that both the 300 Trishrutik **Ga** and $303\frac{11}{27}$ Sankirna Trishrutik **Ga** are alike counted as **three** shrutis from the prime tone **Ri** and assume **one** shruti-name namely the seventh **Ratika** shruti. On the eighth **Roadhri** shruti there will be **Ga** of $270 \times \frac{9}{8} = 303\frac{3}{4}$ vibrations.

(4) Sankirna Chatushruti Antar (Augmented Major Tone)

When an interval of four shrutis is increased by 20 cents it is called '**Sankirna Chatushruti Antar**,' thus,

$\frac{9}{8} \times \frac{2048}{2025} = \frac{256}{225}$ i. e. $204 + 20 = 224$ cents.

	(1) Chatushruti Antar.			**(2) Sankirna Chatushruti Antar.**		
Modern Swaras—	Dha,	2 $\underline{\underline{\text{Ni}}}$.	2 Ni.	Dha,	$\underline{\underline{\text{Ni}}}$,	S-Ni.
Shruti Nos.—	16	18	20	16	18	20
Vibrations—	400,	$426\frac{2}{3}$,	450	400,	$126\frac{2}{3}$,	$455\frac{1}{9}$
Frac: Ratio—	$\frac{16}{15} \times \frac{135}{128} = \frac{9}{8}$			$\frac{16}{15} \times \frac{16}{15} = \frac{256}{225}$		
Cents—	112 + 92 = 204			112 + 112 = 224		

It will be seen from the above illustrations that both the Chatushrutik 450 **Ni** and Sankirna Chatushrutik $455\frac{1}{9}$ **Ni** are alike counted as **four** shrutis from the prime tone **Dha**, and assume **one** shruti name namely **Ramya** shruti No. 20. Shruti No. 21 will be four shrutis from 405 **Dha**, hence there will be $405 \times \frac{9}{8} = 455\frac{5}{8}$ **Ni** on **Ugra** shruti No. 21.

Here ends a full and detailed description of all the various intervals of the modern **Natural Scale of 22 Tones** in the octave of Indian music.

CHAPTER X.

Arrangement of 22 Shrutis in the Octave

The number of shrutis in an octave can be infinite. To prove this we will take the instance of an interval of four shrutis of the modern prime tones 240 **Sa** to 270 **Ri.**

There are three kinds of interval of **one** shruti, namely $\frac{81}{80}$, $\frac{25}{24}$ and $\frac{256}{243}$, hence there will be three varieties of **Ri** on the first Tivra shruti as follows :—

(1) $240 \times \frac{81}{80} = 243$ $\underline{\underline{\text{Ri}}}$, (2) $240 \times \frac{25}{24} = 250$ $\underline{\underline{\text{Ri}}}$, (3) $240 \times \frac{256}{243} = 252\frac{68}{81}$ $\underline{\underline{\text{Ri}}}$.

Out of these three varieties $252\frac{68}{81}$ $\underline{\underline{\text{Ri}}}$, being at Sankirna Shruti Antar from 240 tonic **Sa**, is the only note that is used in ragas.

There are two kinds of the interval of **two** shrutis, namely $\frac{135}{128}$ and $\frac{16}{15}$, hence there will be two varieties of **Ri** on the second Kumudvati shruti as follows :—

(1) $240 \times \frac{135}{128} = 253\frac{1}{8}$ Ri, (2) $240 \times \frac{16}{15} = 256$ Ri.

Both these varieties are used in ragas.

There are two kinds of the interval of **three** shrutis, namely $\frac{10}{9}$ and $\frac{4096}{3645}$, hence there will be two varieties of **Ri** on the third Manda shruti as follows :—

(1) $240 \times \frac{10}{9} = 266\frac{2}{3}$ Ri, (2) $240 \times \frac{4096}{3645} = 269\frac{169}{243}$ Ri.

Out of these two varieties, only $266\frac{2}{3}$ Ri is used in ragas.

There are two kinds of the interval of four shrutis, $\frac{9}{8}$ and $\frac{256}{225}$, hence there will be two varieties of **Ri** on the fourth Chandovati shruti as follows : —

(1) $240 \times \frac{9}{8} = 270$ **Ri**, (2) $240 \times \frac{256}{225} = 273\frac{1}{15}$ Ri.

Out of these two varieties, only 270 **Ri** is used in ragas.

Thus it will be quite evident that within an interval of four shrutis of the modern prime tones **Sa** and **Ri** there can be nine varieties of **Ri**. Similarly there will be many varieties of the other prime tones also, and consequently the number of shrutis in an octave will be infinite. Out of these shrutis, only those, that are made use of in our ragas and which stand in samvadi (concordant) relationship with one another, are taken into consideration discarding the rest. Then with a view to further minimumise the number of shrutis those two shrutis, that are separated from each other by an interval of 20 cents, are counted as **one** shruti only, thus fixing the total number to 22 in the octave. This has remained the accepted number ever since.

CHAPTER XI

The Modern Natural Scale of 22 Tones evolved out of Bharata's Sa-Grama Scale of 22 Shrutis and 9 Natural Notes in the octave.

Ma-Grama trishrutik Panchama is called **Chute** or **Laghu Panchama.** The location of the ancient Sa-Grama chatushrutik Panchama is on Alapini shruti No. 17, hence that of Ma-Grama trishrutik Panchama will be on Sandipini shruti No. 16 Bharata calls this Sandipini shruti of Ma-Grama Panchama a '**Praman Shruti**' or an indicative interval, because all the twenty-two shrutis of the octave can be deduced from this Praman Shruti by Panchama-Bhava samvad.

By deducting trishruti Antar of Ma-Grama Panchama from chatushruti Antar of Sa-Grama Panchama we get the fractional value of the Praman Shruti as already stated in the previous chapter, thus

$\frac{9}{8} \div \frac{10}{9} = \frac{81}{80}$ i. e. $204 - 182 = 22$ cents.

The vibrations of the chatushrutik Panchama are 360, hence the vibrations of the trishrutik or Laghu Panchama will be $360 \div \frac{81}{80} = 355\frac{5}{9}$. From this $355\frac{5}{9}$ Ma-Grama Laghu Panchama we get all the modern twenty-two shrutiswaras of the octave by Panchama-Bhava samvad $(\frac{3}{2})$. See the accompanying chart.

All the notes in the chart are printed according to the notation system adopted for this treatise.

(Chart No. 5).

22 Swaras obtained by Panchama-Bhava Samvad from Ma-Grama Chute or Laghu Panchama.

Swaras Nos.	Names & vibrations of 22 Swaras.	Names and vibrations of Panchama-Bhava Samvadi Swaras.
1	$355\frac{5}{9}$ Laghu Pa	$266\frac{2}{3}$ Ri
2	$266\frac{2}{3}$ Ri	400 Dha
3	400 Dha	300 Ga
4	300 Ga	450 Ni
5	450 Ni	$337\frac{1}{2}$ Ma
6	$337\frac{1}{2}$ Ma	$253\frac{1}{8}$ $\underline{\underline{\text{Ri}}}$
7	$253\frac{1}{8}$ $\underline{\underline{\text{Ri}}}$	$379\frac{11}{16}$ $\underline{\underline{\text{Dha}}}$ $379\frac{7}{27}$ $\underline{\underline{\text{Dha}}}$
8	$379\frac{7}{27}$ $\underline{\underline{\text{Dha}}}$	$284\frac{4}{9}$ $\underline{\underline{\text{Ga}}}$
9	$284\frac{4}{9}$ $\underline{\underline{\text{Ga}}}$	$426\frac{2}{3}$ $\underline{\underline{\text{Ni}}}$
10	$426\frac{2}{3}$ $\underline{\underline{\text{Ni}}}$	320 $\underline{\text{Ma}}$
11	320 $\underline{\text{Ma}}$	240 Sa
12	240 Sa	360 Pa
13	360 Pa	270 Ri
14	270 Ri	405 Dha
15	405 Dha	$303\frac{3}{4}$ Ga $303\frac{11}{27}$ S-Ga
16	$303\frac{11}{27}$ S-Ga	$455\frac{1}{9}$ S-Ni
17	$455\frac{1}{9}$ S-Ni	$341\frac{1}{3}$ S-Ma
18	$341\frac{1}{3}$ S-Ma	256 $\underline{\text{Ri}}$
19	256 $\underline{\text{Ri}}$	384 $\underline{\text{Dha}}$
20	384 $\underline{\text{Dha}}$	288 $\underline{\text{Ga}}$
21	288 $\underline{\text{Ga}}$	432 $\underline{\text{Ni}}$
22	432 $\underline{\text{Ni}}$	

Note—This chart is very useful to all the students of Indian Music to know the samvadi (concordant) relationship of all the notes of various Ragas.

Out of the notes of the chart, those that are used in our raga-melodies can be arranged in order of pitch, thus

Sa, $\underline{\underline{\text{Ri}}}$, $\underline{\text{Ri}}$, Ri, **Ri**, $\underline{\underline{\text{Ga}}}$, $\underline{\text{Ga}}$, **Ga**, S-Ga, $\underline{\textbf{Ma}}$,
240, $253\frac{1}{3}$, 256, $266\frac{2}{3}$, 270. $284\frac{4}{9}$, 288, 300, $303\frac{13}{27}$, 320,

Ma, S-Ma, (Ma, Laghu Pa), **Pa**, $\underline{\underline{\text{Dha}}}$, $\underline{\text{Dha}}$, Dha, **Dha**, $\underline{\underline{\text{Ni}}}$,
$337\frac{1}{2}$, $341\frac{1}{3}$, $355\frac{5}{9}$, 360, $379\frac{11}{16}$, 384, 400, 405. $426\frac{2}{3}$.

$\underline{\text{Ni}}$, **Ni**, S-Ni, **Ṡa**. (In all 22 notes.)
432, 450. $455\frac{1}{9}$, 480.

Note—The seven notes of the modern fundamental scale are printed in bold types. Their vikrit notes are all printed in ordinary types.

In modern music the tonic **Sa** and its natural consonant **Pa**, being '**avikrit**' or '**achal**' (stationary), do not under any circumstances take the names of their respective preceding notes. The remaining five notes of the fundamental scale assume four varieties, which are called by the Muhomedan musicians Atikomal, Komal, Tivra and Tivratar respectively. As the note **Pa** is 'avikrit' in modern music, $355\frac{5}{9}$ Ma i. e. Laghu Pa is not used in our raga-melodies.

The accompanying chart will show how the above twenty-two notes have evolved out of Bharata's Sa-Grama scale of 9 Natural Notes distributed among 22 shrutis in the octave.

(Latest Research) Chart No. 6.

Modern Natural Scale of 22 Tones evolved out of Bharata's Sa-Grama Scale of 22 Shrutis and 9 Natural Notes in the Octave.

Shruti No.	Names of Shrutis.	Names of Swaras of Bharata.	Modern Shruti-Sankhia-Vachak Names of Swaras.	Popular Names of Swaras.	Vibrations.
0	Kshobhini	Shuddha **Ni**	- **Sa**	Shuddha	240
1	Tivra				$(252\frac{65}{81})$
2	Kumudvati	**Kakli-Ni**	Laghu Dwishrutik $\underline{\underline{\text{Ri}}}$	Atikomal	$253\frac{1}{8}$
	..		Dwishrutik $\underline{\text{Ri}}$	Komal	256
3	Manda		Trishrutik Ri	Tivra	$266\frac{2}{3}$
4	Chandovati	Shuddha **Sa**	Chatushrutik **Ri**	Tivratar	270
5	Dayavanti		Sankirna Shrutik $\underline{\underline{\text{Ga}}}$	Atikomal	$284\frac{4}{9}$
6	Rajani		Dwishrutik $\underline{\text{Ga}}$	Komal	288
7	Ratika	Shuddha **Ri**	Trishrutik **Ga**	Tivra	300
	"		Sankirna Trishrutik S-Ga	S-Tivra	$303\frac{11}{27}$
8	Roadhri				$(303\frac{3}{4})$

9	Kroadha	Shuddha **Ga**	Dwishrutik **Ma**	Komal	320
10	Vajrika				(324)
11	Prasarini	**Antar-Ga**	Chatushrutik Ma	Tivratar	$337\frac{1}{2}$
	”		Sankirna Chatushrutik S-Ma	S-Tivratar	$341\frac{1}{3}$
12	Preeti				$(355\frac{5}{9})$
13	Marjani	Shuddha **Ma**	**Pa**	Shuddha	360
14	Kshiti				$(379\frac{7}{27})$
15	Rakta		Laghu Dwishrutik Dha	Atikomal	$379\frac{11}{16}$
	”		Dwishrutik Dha	Komal	384
16	Sandipini		Trishrutik Dha	Tivra	400
17	Alapini	Shuddha **Pa**	Chatushrutik **Dha**	Tivratar	405
18	Madanti		Sankirna Shrutik Ni	Atikomal	$426\frac{2}{3}$
19	Roahini		Dwishrutik Ni	Komal	432
20	Ramya	Shuddha **Dha**	Trishrutik **Ni**	Tivra	450
	”		Sankirna Trishrutik S-Ni	S-Tivra	$455\frac{1}{9}$
21	Ugra				$(455\frac{5}{8})$
22	Kshobhini	Shuddha **Ni**	**Ṡa**	Shuddha	480

(1) $252\frac{68}{81}$ Sankirna Shrutik (Diminished Soft Semi-tone) Ri on Shruti No. 1

=

(2) $379\frac{7}{27}$ Sankirna Shrutik Dha on Shruti No. 14.

Chart No. 7.

Fractional Ratios of the Intervals of 22 Tones of Indian Music.

Shruti Nos.	Names and vibrations of Notes.	Fractional Ratios.	Cents.	Length of the speaking wire from the bridge in inches.
0	240 **Sa**			36
2	$253\frac{1}{8}$ $\underline{\text{Ri}}$	128 : 135	92	$34\frac{2}{15}$
"	256 $\overline{\underline{\text{Ri}}}$	2025 : 2048	20	$33\frac{3}{4}$
3	$266\frac{2}{3}$ Ri	24 : 25	70	$32\frac{2}{5}$
4	270 **Ri**	80 : 81	22	32
5	$284\frac{4}{9}$ $\underline{\text{Ga}}$	243 : 256	90	$30\frac{3}{8}$
6	288 $\overline{\underline{\text{Ga}}}$	80 : 81	22	30
7	300 **Ga**	24 : 25	70	$28\frac{4}{5}$
"	$303\frac{11}{27}$ S-Ga	2025 : 2048	20	$28\frac{61}{128}$
9	320 $\underline{\textbf{Ma}}$	128 : 135	92	27
11	$337\frac{1}{2}$ Ma	128 : 135	92	$25\frac{3}{5}$
"	$341\frac{1}{3}$ S-Ma	2025 : 2048	20	$25\frac{5}{16}$
13	360 **Pa**	128 : 135	92	24
15	$379\frac{11}{16}$ $\underline{\text{Dha}}$	128 : 135	92	$22\frac{34}{45}$
"	384 $\overline{\underline{\text{Dha}}}$	2025 : 2048	20	$22\frac{1}{2}$
16	400 Dha	24 : 25	70	$21\frac{3}{5}$
17	405 **Dha**	80 : 81	22	$21\frac{1}{3}$
18	$426\frac{2}{3}$ $\underline{\text{Ni}}$	243 : 256	90	$20\frac{1}{4}$
19	432 $\overline{\underline{\text{Ni}}}$	80 : 81	22	20
20	450 **Ni**	24 : 25	70	$19\frac{1}{5}$
"	$455\frac{1}{9}$ S-Ni	2025 : 2048	20	$18\frac{63}{64}$
22	480 **Sa**	128 : 135	92	18
		Total...	1200	

Note—Multiplication of all the fractional ratios will be 2.

By close study of the natural scale it will be seen that all notes stand in Panchama-Bhava samvadi (concordant) relationship with one another. It should be borne in mind that vibrations play a most important part in determining the samvadi relationship of notes, while shruti intervals for ascertaining their accurate pitch.

It is erroneous to say that there is no harmony in Indian music. Our scale of 22 Tones itself is based purely on natural harmony; moreover there cannot be any raga without its notes being in samvadi relationship with one another. It would, therefore, be far becoming to say that harmony of Indian music is quite natural, while that of Western music is simply coarse and artificial.

A glance at the chart will show that our modern Natural Scale of 22 Tones evolves out of the ancient Bharata's Scale of 22 shrutis and 9 Natural swaras in the octave. This goes to prove without any doubt that **the scale used by our modern musicians is the same as that expounded by Bharata in the early part of the sixth century A.D.**.

CHAPTER XII

Sarna - Chatushtayi (Four Diminutions) of Bharata.

As stated in the previous chapter the difference between 360 Shuddha **Pa** of Sa-Grama and $355\frac{5}{9}$ **Laghu Pa** of Ma-Grama is the **Comma of Didymus** ($\frac{\text{Major Tone}}{\text{Minor Tone}} = \frac{9}{8} \div \frac{10}{9} = \frac{81}{80}$ i. e. 22 cents). Bharata calls this Comma the '**Praman**' (Indicative) **Shruti**, because all the other intervals can be deduced from it.

Take two Veenas, he says, alike in all respects, and tune them both in the Sa-Grama. One of them he calls

'Chal-Veena' and the other 'Dhruva-Veena'. On this second Dhruva-Veena diminish the note **Pa** by the Praman Shruti ($\frac{81}{80}$) in sach a way that this **Laghu Pa** of Ma-Grama will coincide with the shuddha **Pa** of Sa-Grama of the first Chal-Veena.

Note—All diminutions of notes are effected by raising the pitch of the wire of Dhruva-Veena.

By the second diminution the two notes Dwishrutik **Ga** and **Ni** on Dhruva-Veena will coincide with the two notes **Ri** and **Dha** of Chal-Veena. This is the diminution of two shrutis. The second shruti then is the difference between the Semi-tone and the Praman Shruti ($\frac{16}{15} \div \frac{81}{80} = \frac{256}{243}$ i. e. 90 cents).

By a third diminution the two notes Trishrutik **Ri** and **Dha** on Dhruva-Veena will coincide with the two notes **Sa** and **Pa** of Chal-Veena. This is the diminution of three shrutis. The third shruti then is the difference between the Minor Tone and Semi-tone ($\frac{10}{9} \div \frac{16}{15} = \frac{25}{21}$ i. e. 70 cents).

By a fourth diminution the three notes Chatushrutik **Sa**, **Ma** and **Pa** on Dhruva-Veena will coincide with the three notes **Ni**, **Ga** and **Ma** of Chal-Veena. This is the diminution of four shrutis. The fourth shruti then is the difference between the Major Tone and Minor Tone ($\frac{9}{8} \div \frac{10}{9} = \frac{81}{80}$ i. e. 22 cents, the Praman Shruti).

All the above four diminutions clearly establish the fact that the Shrutis of our ancient Shastra-writers were not equal in size i. e. **the Shruti was not a fixed unit.**

By the above four diminutions on the Dhruva-Veena we get our modern fundamental scale of seven Shuddha swaras, as will be clearly evident from the annexed chart. This scale is played on Sa-wire of our modern stringed instruments from Mairu (Nut).

(Latest Research) Chart No. 8.
Sarna-Chatushtayi (Four Diminutions) of Bharata.

	Chal-Veena		Dhruva-Veena.				
	Names of Shrutis.	Bharata's Shuddha Swaras	First Dimn:	Second Dimn:	Third Dimn:	Fourth Dimn:	Modern Fundamental Scale of Sa wire
(Mairu)	Kshobhini	**Ni**				**Sa**	**Sa**
1	Tivra				Sa		
2	Kumudvati			Sa			
3	Manda		Sa				
4	Chandovati	4 **Sa**			**Ri**		4 **Ri**
5	Dayavanti			Ri			
6	Rajjani		Ri				
7	Ratika	3 **Ri**		**Ga**			3 **Ga**
8	Roadhri		Ga				
9	Kroadha	2 **Ga**				**Ma**	2 **Ma**
10	Vajrika				Ma		
11	Prasarini			Ma			
12	Preeti		Ma				
13	Marjani	4 **Ma**				**Pa**	4 **Pa**
14	Kshiti				Pa		
15	Rakta			Pa			
16	Sandipini		L-Pa				
17	Alapini	4 **Pa**			**Dha**		4 **Dha**
18	Madanti			Dha			
19	Roahini		Dha				
20	Ramya	3 **Dha**		**Ni**			3 **Ni**
21	Ugra		Ni				
22	Kshobhini	2 **Ni**					2 **Ṡa**

CHAPTER XIII.

Varieties of Swarantars (Intervals of Notes) of Raga-Scales.

All the twenty-two notes of the natural scale are not used simultaneously in any raga. As a rule the maximum number of notes, that can be used in a raga, is nine, and the minimum number of notes is five only. When there is a combination of more than nine notes in a melody, it is a 'mishra' raga i. e. a combination of several ragas. A combination of less than five notes will be a 'Tana' (तान).

In the raga-scale of seven notes there are no two semi-tones together, such as Ri **Ri**, Ga **Ga**, **Ma** Ma, and so on. Although there can be two semi-tones together in raga-scales of eight and nine notes, as a rule in Indian music they cannot occur consecutively (come one after another) in any raga-melody, because such a process is not agreeable to our style of the art. Out of the two semi-tones, the first semi-tone is generally used in 'avaroha' (descent) only. Some musicians do use them together very sparingly in a few ragas like Kedara, Bihaga, Lalilta, Mia Malhar, etc., for the sake of embellishment only.

It should be thoroughly borne in mind that in raga-scale as well as in arrangement of frets on stringed instruments there cannot be a swara at any of the shruti or enharmonic intervals of 70, 22 or 20 cents, as these intervals are merely Shruti Antars and not Swarantars, as already explained in chapter IX. All the Swarantars, that are used in our raga-scales, are given in the accompanying chart with names of their respective notes.

Chart No. 9

Varieties of Swarantars of Raga-Scales.

Frac : Ratios	Cents	Shruti Sankhiavachak Names of the Notes	Popular Names of the Notes	Western Names of the Notes
$\frac{256}{225}$	224	**Sankirna Chatushrutik**	**Sankirna Tivratar**	**Sharpened or Augmented Major Tone**
$\frac{9}{8}$	204	**Chatushrutik**	**Tivratar**	**Major Tone**
$\frac{4096}{3645}$	202	**Sankirna Trishrutik**	**Sankirna Tivra**	**Augmented Minor Tone**
$\frac{10}{9}$	182	**Trishrutik**	**Tivra**	**Minor Tone**
$\frac{16}{15}$	112	**Dwishrutik**	**Komal**	**Semi Tone**
$\frac{135}{128}$	92	**Laghu Dwishrutik**	**Atikomal**	**Soft Semi Tone**
$\frac{256}{243}$	90	**Sankirna Shrutik**	,,	**Diminished Soft Semi-Tone**

As there is a very minute difference of only two cents between the notes at the intervals of 92 and 90 cents, both are alike named '**Atikomal**' swaras in this treatise. It is far more advisable to know all the notes by their Shruti-Sankhiavachak names than by the popular vague terms like Atikomal, Komal, Tivra, Tivratar, etc.

CHAPTER XIV.

Swaras produced by 12 Frets on Sa, Ma and Pa Wires in the Octave of Stringed Instruments.

The largest variety of musical instruments in India is found among the strings. The Veena occupies the first place among them all, and has done so from time immemorial. It is also the instrument par excellence for rendering Indian music. In Northern India the Veena is called 'Been'. The Veena lends itself to all the different graces which give so much beauty to Indian music, and in the hands of really capable performers it produces most wonderful and charming effects. It is an ideal instrument for an Indian student to learn. It is hoped that more and more the unsuitable harmonium with its strident tones will give place to this beautiful Indian instrument, an instrument affording not only delight to player and hearers, but also real culture. No one, who has not heard the masters of the Veena, has any right to give a final judgment on Indian music. The principles of the popular Sitar are the same as those of the Veena, but there are considerable differences in construction. In Sitar the frets are movable at the will of the player, hence it is easy to alter the size of any particular intervals.

The frets of the Veena or Sitar are supposed to mark the points at which the strings should be stopped with the finger to get the different notes of the scale. Through examining a number of specimens a rude average has been obtained, which seems to indicate a system curiously like the modern European system of twelve Semi Tones in the octave. But it is clear, this can be only a rough approximate scheme upon which more delicate variations of relative pitch are to be grafted, for the actual system of Indian scales is too complicated to be provided for by a mere arrangement of twelve equal Semi Tones.

As most of our readers know, a Binkar or a Sitarist is not restricted to the notes given by his frets. He can produce all delicate variations of relative pitch by shifting the frets or by '**meenda**' (मींड) i. e. by pulling the wire sideways. The method of placing twelve important frets (or even less) in an octave was adopted as the most convenient for a performer who wished to interpret with comparative facility a wide range of notes. If there were placed a separate fret for each of the twenty-two tones, naturally the frets will come too close to each other, thus making play most inconvenient.

The wires of all the stringed instruments are always tuned **to Sa, Ma** and **Pa** i. e. in **Samvadi relationship** with one another. As every performer knows, the **Tonic Sa** of the scale of Veena, Sitar, Dilruba, etc., is on **fret No. 7 of the Ma-wire**, which is played upon most, though expert players will use all the three wires easily. The accompanying chart will clearly show the notes that are produced on the twelve frets on **Sa, Ma** and **Pa** wires in the octave of the above instruments, commencing from fret No. 7, which is the tonic **Sa.** As aforesaid the intermediate vikrit notes are produced by shifting the frets downwards or upwards as the case may be or by '**Meenda'. Meenda** means the gradual merging of tones or gliding between tones. This has always been an essential element of Indian Music and marks a fundamental difference in conception between the Western theory of musical intervals or empty spaces between notes and the Indian theory of the natural growth and flowing continuity of sound.

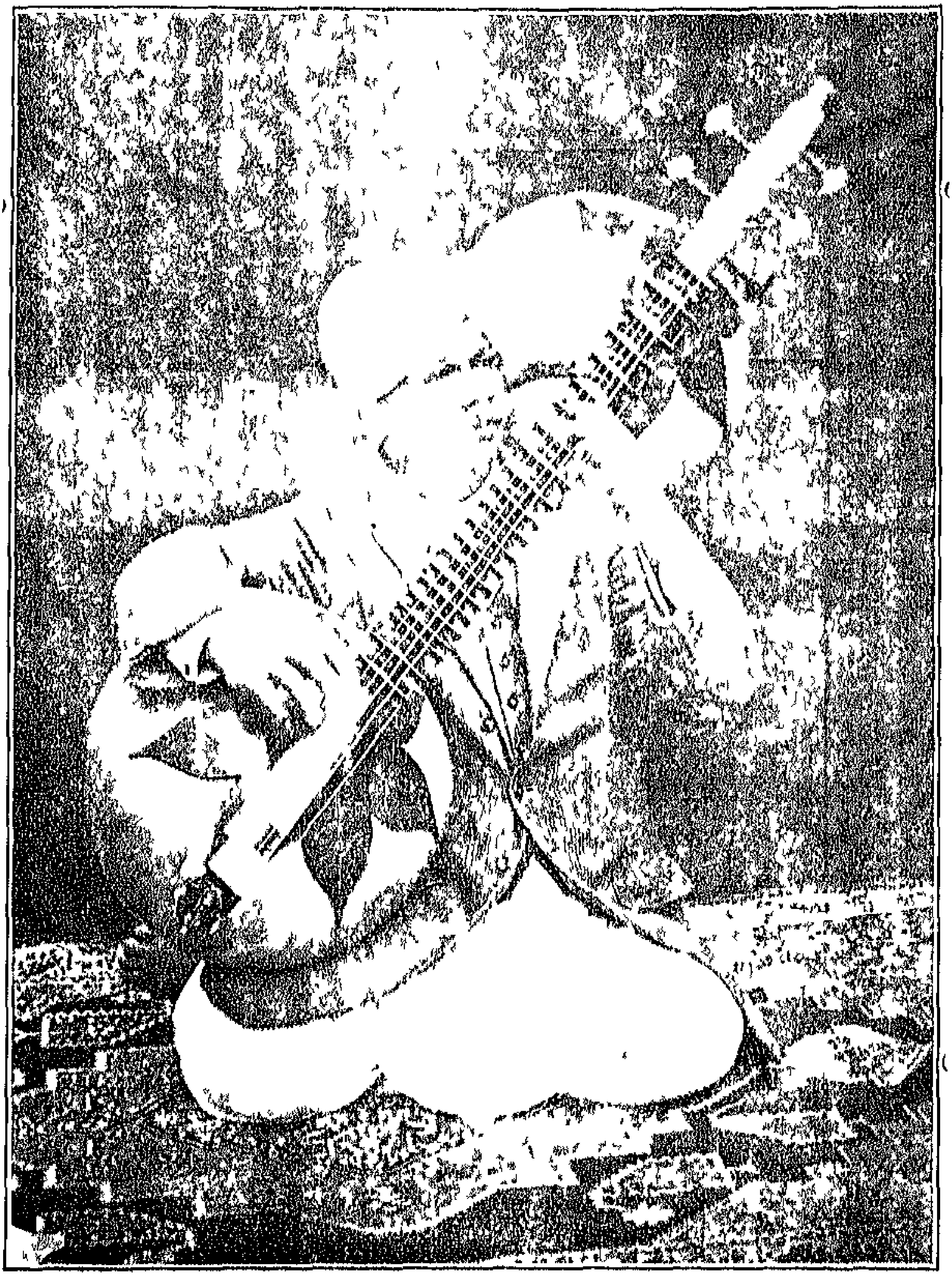
While it is true that alterations of pitch in the melodies took place by intervals in the primitive stage of melody music, continuity of transition has got a very, if not, the most important place in developed melody music as that of India, unfortunately unknown to the West as her many other styles of arts. This continuity of transitions is easily shown by vocal or instrumental demonstration. While a raga has a definite number of notes it uses in two directional movements Arohi (ascent) and Avarohi (descent), some of the constituent transitions are peculiar to itself only, and have great æsthetic influence in this reproduction or representation. The continuity or transition is the most important factor in Indian classical style It is clear that in European music, notes have independent existence and not linked as is characteristic of Indian music.

Smooth transitions, the wavy movements of notes, artistic twists, and the soft and passing shades are very necessary for the expression of our raga-music. It is very difficult to convey the significance of raga in words and **even through notation**, unless one is acquainted with it.

We may sum up by saying that the beauty of Western harmonic music depends on the æsthetic relationship of simultaneously produced compound tones, and the Hindustani Raga music depends for its beauty on the relationship of continuous transitions in æsthetic proportion.

Note—Simply for convenience sake the vibrations of Madhya Saptak (middle octave) are written in the chart for all the notes. The vibrations of the notes of Mandra Saptak (lower octave) will be half, and those of the notes of Tara Saptak (higher octave) will be double the vibrations of the notes of Madhya Saptak, as already explained in chapter VIII.

INDIAN VEENA



PROF. G. B. ACHREKAR (BINKAR).

(Chart No. 10).

Swaras produced by 12 frets on Sa. Ma and Pa wires in the Octave of Veena, Sitar, Dilruba, etc.

Names of Shrutis.	Bharata's Swaras.	Modern Swaras on Sa wire.	Modern Swaras on Pa wire	Modern Swaras on Ma wire.	Scale of Veena, Sitar etc.	Fret Nos.
13 Marjani ...	Ma	360 Pa	270 Ri	Tonic 240 Sa }	Sa	7
14 Kshiti ...						
15 Rakta ...		(384 Dha)	(288 Ga)	(256 Ri)		(8)
16 Sandipini ...						
17 Alapini ...	4 Pa	405 Dha	$303\frac{3}{4}$ Ga	270 Ri	4 Ri	9
18 Madanti ...		($426\frac{2}{3}$ Ni)	(320 Ma)	($284\frac{4}{9}$ Ga)		(10)
19 Roahini ...						
20 Ramya ...	3 Dha	450 Ni	$337\frac{1}{2}$ Ma	300 Ga	3 Ga	11
21 Ugra ...						
22 Kshobhini ...	2 Ni	240 Sa	360 Pa	320 Ma	2 Ma	12

1 Tivra ...						
2 Kumudwati ...	2 **Kakli Ni**	256 Ri	384 Dha	$341\frac{1}{3}$ S-Ma	2 S-Ma	13
3 Manda ...						
4 Chandovati ...	2 **Sa**	270 **Ri**	405 **Dha**	360 **Pa**	2 **Pa**	14
5 Dayavanti ...		($284\frac{4}{9}$ Ga)	($426\frac{2}{3}$ Ni)	($379\frac{7}{27}$ Dha)		(15)
6 Rajjani ...						
7 Ratika ...	3 **Ri**	300 **Ga**	450 **Ni**	400 Ḋha	3 Dha	16
8 Roadhri ...						
9 Kroadha ...	2 **Ga**	320 **Ma**	240 **Sa**	$426\frac{2}{3}$ Ni	2 Ni	17
10 Vajrika ...						
11 Prasarini ...	2 **Antar Ga**	$341\frac{1}{3}$ S-Ma	256 Ri	$455\frac{1}{9}$ S-Ni	2 S-Ni	18
12 Preeti ...						
13 Marjani ...	2 **Ma**	360 **Pa**	270 **Ri**	480 **Ṡa**	2 **Ṡa**	19

CHAPTER XV.

Fallacy of the Scale of 12 Komal Tivra Swaras of Modern Authors.

As stated in the previous chapter the notes produced on the twelve frets in the octave of Veena, Sitar, Dilruba, etc., on $\underline{\text{Ma}}$-wire from the seventh fret as tonic **Sa**, are as under :—

Sa, $\underline{\text{Ri}}$, **Ri**, $\underline{\underline{\text{Ga}}}$, **Ga**, $\underline{\textbf{Ma}}$, S-Ma, **Pa**, $\underline{\underline{\text{Dha}}}$, Dha,

240, 256, 270, $284\frac{4}{9}$, 300, 320, $341\frac{1}{3}$, 360, $379\frac{7}{27}$, 400;

$\underline{\underline{\text{Ni}}}$, S-Ni, $\dot{\textbf{Sa}}$.

$426\frac{2}{3}$, $455\frac{1}{9}$, 480. (All notes are at '**Swarantar**' from each other.)

Frets are supposed to be the '**Swaras**' of the scale of stringed instruments, hence it is absolutely essential that there should always be any of the '**Swarantars**' between them, as fully explained in chapter XIII. There cannot be two frets at any of the '**Shruti Antars**' of 70 cents, 22 cents or 20 cents respectively between them.

There is a common belief among the musicians that the swaras produced on twelve frets of stringed instruments are the twelve Komal Tivra swaras of the scale of modern authors, but this is an erroneous belief, as will be evident from their scale, which runs as follows :—

Sa, $\underline{\text{Ri}}$, **Ri**, $\underline{\text{Ga}}$, **Ga**, $\underline{\textbf{Ma}}$, Ma, **Pa**, $\underline{\text{Dha}}$, **Dha**,

240, 256, 270, 288, 300, 320, $337\frac{1}{2}$, 360, 384, 405,

$\underline{\text{Ni}}$, **Ni**, $\dot{\textbf{Sa}}$.

432, 450, 480.

In the above scale of 12 Komal Tivra swaras the prime tone 300 Tivra **Ga** is at a Shruti interval of $(\frac{300}{288})$ $\frac{25}{24}$ i.e. 70 cents from its vikrit 288 komal $\underline{\text{Ga}}$; similarly the prime tone

450 Tivra **Ni** is at a Shruti interval of $(\frac{450}{432})$ $\frac{25}{24}$ i. e. 70 cents from its vikrit 432 komal Ni. As aforesaid the above two intervals being merely '**Shruti Antars**' and not '**Swarantars**', no frets can be fixed on stringed instruments for the vikrit notes 288 komal Ga and 432 komal Ni. There is an interval of three shrutis ($\frac{10}{9}$) between the prime tones 270 **Ri** and 300 **Ga** ($\frac{300}{270}$), similarly between the prime tones 405 **Dha** and 450 **Ni** ($\frac{450}{405}$). On account of this interval of **three** shrutis, the intermediate vikrit swara between the prime tones 270 **Ri** and 300 **Ga** can only be $270 \times \frac{256}{243} = 284\frac{4}{9}$ Atikomal Ga and not 288 komal Ga, similarly the one between the prime tones 405 **Dha** and 450 **Ni** can only be $405 \times \frac{256}{243} = 426\frac{2}{3}$ Atikomal Ni and not 432 komal Ni. This has been fully explained in chapter IX.

It is, therefore, evident that the scale of twelve Komal Tivra swaras of modern authors cannot be fixed on the frets of stringed instruments.

On comparison of the twelve notes of both the above scales it will be seen that they **vary considerably**. The scale of twelve Komal Tivra swaras of modern authors lack in $284\frac{4}{9}$ Ga, $341\frac{1}{3}$ S-Ma, $379\frac{7}{27}$ Dha, 400 Dha, $426\frac{2}{3}$ Ni and $455\frac{1}{9}$ S-Ni, which are actually played daily by the students in different Ragas on the frets fixed on the stringed instruments. Besides the above six notes there is a deficit of the notes $253\frac{1}{8}$ Ri, $266\frac{2}{3}$ Ri, 303 $\frac{1}{27}$ S-Ga, etc., which are used in our Ragas and are produced on the stringed instruments by shifting the frets or by 'meenda'. This goes to prove without any doubt that the scale of only twelve **Komal Tivra** swaras in the octave is quite **incomplete**. Another proof of the deficiency of notes in this scale is given below.

Melody in Indian music strictly demands that all notes of the scale must have samvadi (concordant) relationship with one another. For samvadi relationship there should always be a fractional ratio of $\frac{4}{3}$ (**Ma**) and $\frac{3}{2}$ (**Pa**) between the notes, as already stated in chapter IX. Accordingly the samvadi notes of the scale of twelve Semi-tones will be as follows :—

Scale - 240 **Sa**, 256 $\underline{\text{Ri}}$, 270 **Ri**, 288 $\underline{\text{Ga}}$, 300 **Ga**, 320 $\underline{\textbf{Ma}}$,
($\underline{\textbf{Ma}}$) - 320 $\underline{\textbf{Ma}}$, $341\frac{1}{3}$ S-Ma, 360 **Pa**, 384 $\underline{\text{Dha}}$, 400 Dha, $426\frac{2}{3}$ $\underline{\underline{\text{Ni}}}$,
(**Pa**) - 360 **Pa**, 384 $\underline{\text{Dha}}$, 405 **Dha**, 432 $\underline{\text{Ni}}$, 450 **Ni**, 480 **Sa**,

Scale - $337\frac{1}{2}$ Ma, 360 **Pa**, 384 $\underline{\text{Dha}}$, 405 **Dha**, 432 $\underline{\text{Ni}}$, 450 **Ni**.
($\underline{\textbf{Ma}}$) - 450 **Ni**, 480 $\dot{\textbf{S}}$**a**, 256 $\underline{\text{Ri}}$, 270 **Ri**, 288 $\underline{\text{Ga}}$, 300 **Ga**,
(**Pa**) - $253\frac{1}{8}$ $\underline{\underline{\text{Ri}}}$, 270 **Ri**, 288 $\underline{\text{Ga}}$, $303\frac{3}{4}$ Ga, 324 Ma, $337\frac{1}{2}$ Ma.

The above chart of the concordant relationship of the twelve Semi-tones will show that there are six extra notes $253\frac{1}{8}$ $\underline{\underline{\text{Ri}}}$, $303\frac{3}{4}$ Ga, 324 Ma, $341\frac{1}{3}$ S-Ma, 400 Dha and $426\frac{2}{3}$ $\underline{\underline{\text{Ni}}}$. This also goes to prove without any doubt that there should be at least **18 notes** in the octave for Indian Raga-melodies and that the scale of only **12 Semi-tones** is ipso facto incomplete. This clearly explains the fallacy of the modern authors' scale of twelve Komal Tivra swaras in the octave, hence **the practice of expressing Ragas in terms only of twelve Komal Tivra swaras should be entirely discouraged.** Moreover the terms 'Komal' and 'Tivra' for notes have no technical value whatever, as they are too vague to ascertain **the accurate pitch and samvadi relationship of notes.** As the Shruti theory of our pre-ancient Shastra-writers was all Greek and Latin to our modern authors, they have tried to compromise their ignorance by introducing the Western scale of 12 Semi-tones for Indian music, thereby doing irreparable harm instead of any good to the cause of this divine art.

CHAPTER XVI.

22 Shrutis and their vital importance for expressing various emotions of Ragas.

Music is the art of expressing the various feelings and emotions by means of the notes. Unfortunately most scholars are content with its superficial effect only, never enquiring how combinations of notes can arouse different mental states. What are the 'prakritis' (feelings) of natural and their various Vikrit notes? Why are they termed so? What is the difference in their feeling? What notes aro used to express joy and what notes to express sorrow? Such vital questions are entirely neglected. To make the position clear and with due respect to the profession it will not be out of place to mention here that the modern musician, with all his skill in compounding the notes, may be compared to a cook who knows neither the chemical properties of the raw articles he uses, nor the after-effect of the rich viands he so deliciously prepares. The musician, however, cannot harm like the cook, because music, even at its worst, is only annoying. Suffice it to say that **the combinations of notes play a most important part in expressing the various emotions of Indian Raga-melodies.**

Some critics lightly brush aside the above principle, stating that a genius can use any Raga for expressing any emotion. Such people ought to remember that though a pot can be made of steel, brass, copper, silver or gold, not to mention clay, these metals have their own property; and though out of gold a pin, a pot, a sword or a piece of cannon can be made, the property of gold is quite definite and distinct. Similarly though a Raga may express several emotions, **it has its own distinctive feeling.**

The root meaning of Raga is '**Passion**'. The very fact of putting passion (**रस**, emotion) into music means that a particular note will be taken rather flatter or sharper at one time than at another. The law is there of course to be obeyed **as perfectly as possible.** The use of the term '**Shruti**' for such a possible flattening or sharpening of particular notes recognizes the truth of this variability. For instance, as will be quite evident from the study of Part II of this treatise that those notes that are 'Atikomal' (Soft Semi-tones) in Bilaskhani, Asavari and Bageshri Ragas are 'Komal' (Semi-tones) in their corresponding Bhairavi, Darbari and Kafi Ragas respectively. Should komal notes of the latter be used in place of Atikomal notes in Bilaskhani, Asavari and Bageshri Ragas, their distinctive 'karun rasa' (compassion sentiment) will be entirely lost. It is, therefore, an accepted rule in Indian music **to use only the prescribed Shruti-Swaras** for expressing the various emotions of the Ragas. It will be quite evident from the study of Part II that each and every note of our Natural Scale of 22 Tones is made use of **quite independently of one another** in all our Raga Scales.

It is, therefore, worse than preposterous for the advocates of the scale of twelve Semi-tones in the octave for Indian music to say that the twenty-two shrutis of our ancient Shastra-writers are merely 'alankarik' (ornamental), vague, unimportant and airy, and serve no practical purpose. This indiscreet and misleading statement is a clear evidence that these zealots of the Western incomplete scale of twelve Semi-tones in the octave for our Indian music hopelessly lack in adequate knowledge of the shrutis – the fruit of the high genius of our pre-ancient sages and their vital importance in Indian music. These advocates should well remember that the Western scale of twelve Semi-tones in the octave may be suitable to our folk or street music of the lowest order, but is not at all advisable for the classical artistic music of India.

The appearance and arrangement of 22 shrutis in the scale of Indian music, and also our Ma-Grama scale which is identical with the Western Major mode (see page 30), afford the clearest evidence that our pre-ancient Shastra-writers had a profound understanding of the laws of sound in relation to music. Our music in the past was highly systematised and the system adopted was the best for its needs. I would even go further and say that the system adopted by our old Shastra-writers has been found suitable even for the classification and systematisation of our modern Ragas, as will be quite evident from the study of Part II of this treatise. It is mainly the subsequent scholars who are solely responsible for the present grave deterioration of our noble and ancient heritage of India. It now badly needs to be revived with care and love.

The appearance of 'vikrits' (chromatic notes roughly) and the twenty-two shrutis in the Indian music has the purpose of explaining the finer shades in the variations of notes. These artistic variations of pitch can be expressed in the word **'intonation'** (lit. rise and fall in the musical pitch of the voice), and this intonation is one of prime importance and value in the evolution of the Raga-melody of Indian Music. It can only be had from our natural Shruti Scale of 22 Tones and not from the modern authors' incomplete scale of 12 Komal Tivra swaras, hence it needs to be discarded by all the students of Indian music from the very initial stage of their study.

Remember that the music, founded on the scale of only twelve semi-tones in the octave, must be considered as imperfect music, and far below our musical sensibility and aspirations. That it is endured and even thought beautiful, only shows that our ears have been systematically falsified from infancy. It would certainly be very desirable to return to our ancient Natural Scale of twenty-two shrutis in the octave, for it cannot be denied that the scale of twelve Semitones, which simple though it may be, has given to music, founded on simple and exact laws, a character of almost coarse approximation.

CHAPTER XVII.

Harmonics or Upper-Partials.

The ear, when its attention has been properly directed to the effect of the vibrations which strike it, does not hear merely that one musical tone, whose pitch is determined by the period of the vibrations, but in addition to this it becomes aware of a whole series of higher musical tones (certain other notes which are present in it at various pitches and intensities), which we call the harmonic upper-partials of the whole musical tone or note, in contradistinction to the fundamental or prime partial tone, or simply the prime, which is the lowest and generally the loudest of all the partial tones, and by the pitch of which we judge the pitch of the whole compound musical tone itself. The series of these upper-partials is precisely the same for all compound musical tones, which correspond to a uniformly periodical motion of the air. It is as follows :—

The first upper-partial tone (or second partial tone) is the upper octave of the prime tone, and makes double the number of vibrations in the same time. If we call the prime 240 **Sa**, this upper partial will be 480 **Ṡa**.

The second upper-partial (or third partial tone) is the fifth of this octave i. e. **Pa**, making three times as many vibrations as the prime in the same time, i. e. 240 × 3 = 720.

The third upper-partial tone (or fourth partial tone) is the second higher octave, i. e. **Sa**, making four times as many vibrations as the prime in the same time, i. e. 240 × 4 = 960.

The fourth upper-partial (or fifth partial tone) is the major third of this second higher octave, i. e. **Ga** with five times as many vibrations as the prime in the same time, i. e. 240 × 5 = 1200.

Thus they go on, becoming fainter to tones making seven, eight, nine, etc., times as many vibrations in the same time as the prime tone. The upper-partials diminish in intensity as they rise in pitch.

In short, strings in vibrating do not only swing as a whole, but have also several secondary motions, each of which produces a sound proper to itself. A string, when srtuck, vibrates first in its entire length, secondly in two segments, thirdly in three, fourthly in four and so on. All of these motions are simultaneous, and the sounds proceeding from them are blended into one note. The lowest note is the loudest, and is called the fundamental or prime tone, and the others are called overtones, upper-partials or harmonics.

It is this natural progression of sound which forms the basis of our Indian melodic music. It is far more natural to man than the Western system of harmony, which compromises with Nature by creating an artificial scale of 12 Semi Tones to meet the needs of keyboard instruments like Pianos, Organs, Harmoniums, etc.

The human ear is endowed by nature with the faculty of discrimination in the natural relationship and sequence of tones. Western ears have been so long accustomed to the artificiality of 'Equal Temperament' that they cannot easily appreciate natural tones and distinguish the finer divisions of scale-notes which are characteristic of Indian music. Suffice it to say that in its limited sphere Indian music is most faithful to nature, while the Western is more or less artificial. For want of psychological analysis, the East and the West cannot appreciate each other scientifically.

CHAPTER XVIII

Harmonium and its Tempered Scale.

In the Piano, Organ, Harmonium and other key-board English instruments the **Natural Scale** is dreadfully abused and distorted by the method of what is called **"Equal Temperament"**. They divide the scale into twelve Semitones only. This limited scope of keyed English instruments disqualifies them to perform many of the beautiful airs of Indian music. It is this that accustoms the ear to false notes, hence all 'star' singers never use the Harmonium instrument as accompaniment during singing.

The harmonium has the most destructive influence on Indian music, not only on account of its false tuning and incomplete scale, but also because it robs the musician of his creativeness in improvisation and his confidence in actual performance. The subtle beauty of **'Meenda'** (deflection of the musical wire) and natural intonation, which are the life and soul of the Raga, are entirely lost when Indian music is played on this crude music-box. In short the use of harmonium for our Indian music should be strongly deprecated. It is, however, gratifying to note that efforts are now being made to introduce the Natural Shruti Scale of 22 Tones in the harmonium.

CHAPTER XIX

Use of Tambura as Accompaniment during Singing

The Tambura (a kind of large Veena with four wires and no frets) tuned only to **Sa** (tonic) and **Pa** (the fifth) has been the best instrument for accompaniment during singing from time immemorial. By its consistent reiteration of the fundamental tonic note **Sa** and the natural consonant **Pa** it keeps the musician in tune and stimulates his creative faculty through the sustained resonances and harmonic overtones of the instrument. For extra facility during singing, Sarangi, Dilruba, Violin, etc.. are used along with the Tambura except Veena and Sitar, which are par excellence for rendering Indian music.

The use of the popular Harmonium as accompaniment to singing should be strongly deprecated. We would like to see Tambura in the hand of all Indian singers and to hear beautiful and artistic intonations once more in general use.

END OF PART I

PART II

CLASSIFICATION OF RAGAS
ACCORDING TO
THE TRADITIONAL MURCHANA SYSTEM.

Ragas are grouped under a number of scales known as **Melas** (मेळ) or **Thatas** (थाट), a custom which is nearly 400 years old.

It is an admitted fact that **'Murchanas'** play an important part in the production of Ragas, in other words ancient Murchanas are themselves what we call the present day **'Thatas.'** The great advantage of the classification of Ragas according to Murchanas is this, that one can, simply at a glance, know the exact **Shruti Intervals, Vibrations, Samvadi Relationship,** etc., of all the notes of a Thata before commencing studying Ragas grouped under that Thata. This advantage unfortunately is not manifest in any of the types of classification at present in vogue. There are various types of classificaton worked out by past and present authors **purely according to their own whims and caprice** and not one of them seems to have been based on a **proper scientific method.** This indiscriminate classification of Ragas has been brought about mostly by authors who have advocated the scale of only **twelve Semi tones** in the octave for our Indian music.

Some over-zealous scholars have even gone so far as to attempt to describe the scales of some Ragas by Shruti

Intervals and Vibrations of their notes **according to their own fanciful methods.** These **imaginary Raga scales**, having proved absolutely incorrect, have done great harm instead of any good to the cause of Indian music. It will not be out of place to warn my readers against such misleading literature. The fallacy of some of their Raga scales such as **Bilaval, Yaman, Kafi**, etc., is clearly proved by **concrete facts and figures** in this treatise. Remeber that '**Murchanas**' are the **bases** of all Indian Raga melodies, hence no accurate Thata or Raga scales can ever be worked out **but by the aid of Murchanas only.** Our traditional '**Murchana System**' is **the only system** for the classification of Ragas that can purify our melody-modes and raise the status of this noble art in the domain of music.

A full and detailed description of the classification of Ragas by the traditional Murchana system with **Shruti intervals, Vibrations, Samvadi relationship**, etc., of their notes will be found in this treatise. It is the **latest research**—the fruit of years of author's stupendous labour and a very close study of both the **theoretical** as well as **practical** music. This Murchana system of classification has been thoroughly worked out by co-operation of voice and instrument, so as to come into common use and to find a common basis for the **Northern** as well as **Southern** musical system. It is a system based on **shastric tradition**, which brings together into groups Ragas which have similar features. In all about 170 Ragas are grouped under eleven Murchanas with **Shruti intervals** and **vibrations** of their notes, which will be found very useful by all the students of Indian music to learn the **accurate pitch and Samvadi relationship of notes** of all the Ragas.

CHAPTER I.

Murchanas (Melody Bases, Raga Scales).

Murchanas are developed from both the Sa-Grama and the Ma-Grama by shifting the tonic note **Sa** (Standard note or Drone) to each note of the scale, thus forming seven different scales for each mode, i e. in all 14 scales for both the Gramas. Each Murchana extends downwards i. e. **Sa, Ni, Dha, Pa, Ma, Ga, Ri** in Sa-Grama. Murchanas of Ma-Grama commence from **Ma**, hence their order of extension will be **Ma, Ga, Ri, Sa, Ni, Dha, Pa.**

Murchanas of seven fundamental swaras of both the Gramas are called **'Shuddha'** Murchanas. They have definite names to distinguish them as under :—

7 Shuddha Murchanas of Sa-Grama with their Starting Note.

1 **(Sa) Uttarmandra**, 2 **(Ni) Rajani**, 3 **(Dha) Uttarayata**, 4 **(Pa) Suddha Shadaja**, 5 **(Ma) Matsarikruta**, 6 **(Ga) Ashvakranta**, 7 **(Ri) Abhirudgata.**

7 Shuddha Murchanas of Ma-Grama with their Starting Note.

1 **(Ma) Souviri**, 2 **(Ga) Harinashva**, 3 **(Ri) Kalopanta**, 4 **(Sa) Shuddha Madhya**, 5 **(Ni) Margi**, 6 **(Dha) Pourvi**, 7 **(Pa) Hrashyaka.**

In Bharata's time there were two extra swaras in the octave called Antar-Gandhara and Kakli-Nishada in addition to the seven shuddha swaras. By including only the Antar-Gandhara in seven shuddha swaras we get **'Shuddha Antar'** Murchanas of eight swaras. Similarly by including only the Kakli-Nishada in seven shuddha swaras we get **'Shuddha Kakli'** Murchanas of eight swaras. By including both the Antar-Gandhara and Kakli-Nishada in the seven shuddha swaras we get **'Shuddha Kakli-Antar'** Murchanas of nine swaras.

It will, therefore, be evident that Murchanas can be of seven, eight or nine swaras respectively. The total number of Murchanas of both the Gramas will be 64 as follows :—

Shuddha	Murchanas of 7 swaras	14
Shuddha Kakli	Murchanas of 8 swaras	16
Shuddha Antar	Murchanas of 8 swaras	16
Shuddha Kakli-Antar	Murchanas of 9 swaras	18
	Total.	64

By shifting the tonic **Sa** to each note of the sixty-four murchanas, the shruti values of the intervals will vary, thus forming sixty-four different melody bases (Raga scales). This process is called **'Murchana-Prastar'** i. e. the permutations of the intervals of Raga scales. Out of these sixty-four murchanas, only six murchanas are suitable to our modern Ragas. The rest are discarded, as they, being discordant, are jarring to human ear. Before going through the details of the six murchanas, it is advisable to know some principles relating to modern Thatas, which are described in the next chapter.

CHAPTER II.

Thatas or Melas (Fundamental Modes).

'Raga' is the basis of melody in Indian music and a substitute for the Western scale. Ragas are different series of notes within the octave, which form the bases of all Indian melodies, and are differentiated from each other by the prominence of certain fixed notes and by the sequence of particular notes. Ragas are not the melodies themselves but the groundwork from which the melodies are afterwards formed. A thousand different melodies may be composed upon the same Raga. **'Melody'** is the general term which is vaguely used to denote successions of single notes which are musically effective.

Ragas have probably originated from four main sources, namely (1) Local tribal songs, (2) Devotional songs, (3) Poetical creations and (4) compositions of scientific musicians. Many of these sources may be traced in their names. Raga, therefore, is the attempt of an artistic nation to reduce to law and order the melodies that come and go on the lips of the people.

It is an accepted rule of Indian music that a Raga should have not more than nine notes or less than five notes. Combinations of more than nine notes are called **'Mishra'** Ragas i. e. a mixture of several Ragas. Combinations of less than five notes will be only pleasing **'Tanas'**, but no Ragas.

All Ragas are divided into two main classes, namely **Janak** (primary) Ragas and **Janya** (secondary) Ragas. The first class are also called **'Melakaratas'**, because the Melas or Thatas under which they are grouped, are named after these Janak Ragas. Jayna Ragas are formed by the omission of certain notes of the Janak Raga in the ascent or descent or in both, thus forming a transilient series, the skilful alteration of Vadi swara, etc.

It must always be remembered that in Indian melodies the mood or flavour is of primal importance. The root meaning of Raga is 'passion', and from very ancient times each Raga has been associated with particular passions and emotions. It is, therefore, fitting that each should also have a special time appropriate to it.

A **'Thata'** (lit. **'group-maker'**, because it groups together several Ragas) consists in determining the exact relative distances of the several sounds (notes), which constitute an octave, with respect to each other, while the Raga disposes of those sounds in a given succession and determines the principal sounds. In short, a **'Thata'** means a scale employing certain intervals in a certain order from **Sa** to **Ṡa** above. The same Thata may be adapted to several Ragas by a different order of succession, whereas **no Raga can be played but in its own proper Thata.** Each Thata reveals a distinct characteristic, and we can see the musical affinities which bring the Ragas in each group together.

It is an admitted fact that the Murchanas play an important part in the production of Ragas; in other words ancient Murchanas themselves are what we call the present day Thatas. Before studying different kinds of Murchanas that are used as modern Thatas, it is necessary to bear in mind the following rules relating to Thatas.

(1) Thatas are constructed out of the swaras of Murchanas. According to the principle of Murchanas a Thata can be of seven, eight or nine swaras. A Thata of nine swaras is called a **Janak** (Parental, Primary) **Thata,** from which are derived **Janya** (Derivative) **Thatas** of eight or seven swaras by omitting one or two swaras respectively. *Out of the Janak and its Janya Thatas, only those Thatas* that are suitable to our Raga-melodies, are made use of for the classification of Ragas. In short, a Thata cannot be of more than nine swaras or less than seven swaras.

(2) Murchanas have different names to distinguish them, *similarly a modern Thata of seven, eight or nine* swaras is named after the **Janak** (Primary) **Raga** out of the Ragas attached to it.

(3) It is an accepted rule to use in the Ragas **only those shrutis** that are used in the Thata; in other words as a Thata *is supposed to be a collection of notes* capable of producing Ragas i. e. an **'Originator'** of Ragas, it is absolutely essential that there must not be **a single extra swara** in any of the Ragas besides those of the Thata from which it is originated.

(4) A **'Raga'** is supposed to be the basis of all Indian melodies. As Ragas originate from Thatas it is absolutely essential that there should be melody also in Thatas. Melody can only be had from the samvadi relationship of swaras, hence it is of vital importance that all the swaras of the Thata should stand in samvadi relationship with one another, and that the same concordant relationship must exist *in the swaras of all the Ragas grouped under that* Thata.

(5) Thatas have **'Aroha'** (ascending notes) only. They become Ragas themselves as soon as you give them **'Aroha'** and **'Avaroha'** (descending notes).

We will now go through the details of the six traditional Murchanas *as stated in the previous chapter and see* how they are applicable to the modern Thatas and Ragas.

MASTER ADI FIROZE FRAMJEE (SITARIST).

(Chart No. 11)

Notes of the fixed Frets of Sitar on Sa and $\underline{\text{Ma}}$ wires from the Mairu. (Scale of Janak Thata 'Kedara')

	(Sa-Wire)	(Ma-Wire)
(Mairu)	240 **Sa**	320 $\underline{\text{Ma}}$ (Mandra)
	256 $\underline{\text{Ri}}$	$341\frac{1}{3}$ S-Ma
	270 **Ri**	360 **Pa**
	$284\frac{4}{9}$ $\underline{\underline{\text{Ga}}}$	$379\frac{7}{27}$ $\underline{\underline{\text{Dha}}}$
	300 **Ga**	400 Dha
	320 $\underline{\text{Ma}}$	$426\frac{2}{3}$ $\underline{\underline{\text{Ni}}}$
	$341\frac{1}{3}$ S-Ma	$455\frac{1}{3}$ S-Ni
(Bharata's *Ma*)	360 **Pa**	240 **Tonic Sa** (*Madhya*)
	(Fret No. 8)	
(4 **Pa**)	405 **Dha**	270 **Ri**
	(Fret No. 10)	
(3 **Dha**)	450 **Ni**	300 **Ga**
(2 **Ni**)	240 **Sa**	320 $\underline{\text{Ma}}$
(2 **K-Ni**)	256 $\underline{\text{Ri}}$	$341\frac{1}{3}$ S-Ma
(2 **Sa**)	270 **Ri**	360 **Pa**
	(Fret No. 15)	
(3 **Ri**)	300 **Ga**	400 Dha
(2 **Ga**)	320 $\underline{\text{Ma}}$	$426\frac{2}{3}$ $\underline{\underline{\text{Ni}}}$
(2 **A-Ga**)	$341\frac{1}{3}$ S-Ma	$455\frac{1}{3}$ S-Ni
(2 *Ma*)	360 **Pa**	480 **Ṡa** (**Tara**)

and so on.

Note—Only for facility the vibrations of Madhya Saptak are written for the notes of Mandra Saptak, which should be half of Madhya Saptak. Notes of **Pa**-wire can be had by multiplying the vibrations of notes of **Sa**-wire by $\frac{3}{2}$.

CHAPTER III.

(1) Shuddha Kakli-Antar 'Matsarikruta' Murchana of Sa-Grama, Modern Name-Janak Thata 'Kedara'.

This **'Matsarikruta'** Murchana is the fifth Murchana of Sa-Grama. It is developed by shifting the tonic **Sa** to **Ma** of the Shuddha Kakli-Antar scale of Sa-Grama, as already stated in the first chapter on page 71. The Shuddha Kakli-Antar scale of Sa-Grama, which is the first **'Uttarmandra' Murchana**, is as follows:—

Sa, 3 **Ri**, 2 **Ga**, 2 **A-Ga**, 2 **Ma**, 4 **Pa**, 3 **Dha**, 2 **Ni**, 2 **K-Ni**, 2 **Ṡa**.

Now by shifting the tonic **Sa** to **Ma** of the above scale, we get the scale of the fifth Shuddha Kakli-Antar **'Matsarikruta'** Murchana of Sa-Grama, thus

Murchana—Ma, 4 Pa, 3 Dha, 2 Ni, 2 K-Ni, 2 Sa, 3 Ri, 2Ga, 2 A-Ga, 2Ma

Scale—**Sa**, 4 **Ri**, 3 **Ga**, 2 $\underline{\text{Ma}}$, 2 S-Ma, 2 **Pa**, 3 Dha, 2 $\underline{\underline{\text{Ni}}}$, 2 S-Ni, 2 Ṡa

Shruti Nos.— 4 7 9 11 13 16 18 20 22

Vibrations—240, 270, 300, 320, 341⅓, 360, 400, 426⅔, 455⅕, 480,

Frac: Ratios— $\frac{9}{8} \times \frac{10}{9} \times \frac{16}{15} \times \frac{16}{15} \times \frac{135}{128} \times \frac{10}{9} \times \frac{16}{15} \times \frac{16}{15} \times \frac{135}{128} = 2$

Samvadi Relationship of Swaras.

Notes—	Sa,	Ri,	Ga,	$\underline{\text{Ma}}$,	S-Ma,	Pa,	Dha,	$\underline{\underline{\text{Ni}}}$,	Sa-Ni.
($\underline{\text{Ma}}$)—	$\underline{\text{Ma}}$,	Pa,	Dha,	$\underline{\underline{\text{Ni}}}$,	S-Ni,	Sa,	0,	0,	0.
(Pa)—	Pa,	0,	0,	Sa,	0,	Ri,	Ga,	$\underline{\text{Ma}}$,	S-Ma.

From the above it will be evident that all the notes of the scale stand in samvadi relationship with one another according to the prescribed rule of Thatas. This concordant relationship must exist in all the Ragas grouped under this Janak as well as all its Janya Thatas.

A glance at the scale notes will show that it is the scale of our stringed instruments played on **Ma**-wire from the seventh fret as tonic **Sa** (see charts No. 10 and 11). Although it is the primary scale of all the fret instruments and nearly 50 Ragas are played on this elementary scale by musicians, hardly a few know that it is the traditional scale of the Shuddha Kakli-Antar **'Matsarikruta'** Murchana developed by shifting the tonic **Sa** to Shuddha **Ma** of Bharata's Shuddha Kakli-Antar scale of Sa-Grama.

In the scale there are two varieties of Madhyama and Nishada swaras. Among Ragas using these two varieties of swaras, the prominent Raga is **'Kedara'** of nine swaras, hence the scale of Veena, Sitar, Dilruba, etc., played on **Ma** wire from the seventh fret as tonic **Sa**, is the traditional Shuddha Kakli-Antar **'Matsarikruta'** Murchana of Sa-Grama i. e. the modern Janak Thata **'Kedara'**. In all 8 Ragas are grouped under this Janak Thata.

As already explained in chapter V of Part I, out of four shrutis of **Sa** when **Ni** takes two shrutis, it is called **Kakli-Ni**; consequently the interval between **Shuddha Ni** and **Kakli-Ni** is Dwishrutik ($\frac{16}{15}$). Similarly out of four shrutis of **Ma** when **Ga** takes two shrutis, it is called **Antar-Ga**; consequently the interval between **Shuddha Ga** and **Antar-Ga** is also Dwishrutik ($\frac{16}{15}$). Owing to this Dwishruti Antar the corresponding note of Kakli-Ni is $341\frac{1}{3}$ S-Ma, and that of Antar-~~Sa~~Ga is $455\frac{1}{9}$ S-Ni in the scale of Janak Thata **'Kedara'** (see the following illustrations).

		(Avikrit)				(Avikrit)
Murchana—	Ni,	2 K-Ni,	2 Sa.	Ga,	2 A-Ga,	2 Ma.
'Kedara' Scale—	**Ma**,	2 S-Ma,	2 **Pa**.	Ni,	2 S-Ni,	2 **Ṡa**.
Vibrations—	320,	$341\frac{1}{3}$,	360.	$426\frac{2}{3}$,	$455\frac{1}{9}$,	480.
Frac: Ratios—	$\frac{16}{15}$	$\times \frac{135}{128}$	$= \frac{9}{8}$	$\frac{16}{15}$	$\times \frac{135}{128}$	$= \frac{9}{8}$

It will be evident from the above two illustrations that owing to Dwishruti Antar between **Ni** and **Kakli-Ni**, similarly between **Ga** and **Antar-Ga**, the interval between **K-Ni** (S-ma) and **Sa** (**Pa**), similarly between **Antar-Ga** (S-Ni) and **Ma** (**Sa**) is Laghu Dwishrutik (Soft Semi-tone). Owing to this smallest interval of Laghu Dwishruti, **Sa** and **Ma** were 'avikrit' (stationary) in ancient music, while their corresponding notes **Pa** and **Sa** are 'avikrit in modern music (see the above illustrations).

The interval between 300 **Ga** and $455\frac{1}{9}$ S-Ni of the scale is 20 cents more than 13 shrutis i. e. $455\frac{1}{9}$ S-Ni is the **augmented fifth** of 300 **Ga**, hence being alien to harmony there cannot be samvadi relationship between them. If the interval had been exactly of 13 shrutis between Gandhara and Nishada swaras, the vibrations of Nishada swara would have been $300 \times \frac{3}{2} = 450$. It should, therefore, be particularly borne in mind that in all the Ragas grouped under Janak Thata '**Kedara**' and all its Janya Thatas there is samvadi relationship only between 300 **Ga** and 400 Dha, similarly between $341\frac{1}{3}$ Sa-Ma and $455\frac{1}{9}$ S-Ni, as will be quite evident from the aforesaid chart of 'Samvadi Relationship of Swaras'. It is, therefore, incorrect and misleading to say '**Gandhara Vadi and Nishada Samvadi**' in **Yaman Raga** as well as all other Ragas attached to the **Kedara** group. This inaccuracy of the modern authors is purely due to their adopting the incomplete scale of only twelve Semi-tones in the octave for Indian Music.

It is erroneous and misleading to say that the **fourth** and the **fifth** always stand in samvadi relationship with the prime tone. Although Nishada swara is the fifth of Gandhara swara, there is no samvadi relationship between them in this '**Kedara**' scale, as $455\frac{1}{9}$ S-Ni is an **augmented** or **sharpened fifth** and not the exact fifth which is $300 \times \frac{3}{2} = 450$ **Ni.**

There are in all 9 swaras in the Janak Thata '**Kedara**' having two varieties of Madhyama and Nishada swaras. By omitting **one** swara out of them at a time, four Janya Thatas of 8 swaras each can be derived; similarly by omitting **two** swaras out of them at a time, four Janya Thatas of 7 swaras each can be derived, thus

4 Janya Thatas of 8 Swaras.

(1) By omitting $426\frac{2}{3}$ Ni we get the scale of Janya Thata '**Shuddha Kalyan**'. 6 Ragas are grouped under this Janya Thata.

(2) By omitting $341\frac{1}{3}$ S-Ma we get the scale of Janya Thata '**Khamaja**'. 18 Ragas are grouped under this Janya Thata.

By omitting $455\frac{1}{9}$ S-Ni we get the third Janya Thata, similarly by omitting 320 **Ma** we get the fourth Janya Thata. These two Thatas, being unsuitable to our Ragas, are discarded.

4 Janya Thatas of 7 Swaras.

(1) By omitting 320 **Ma** and $426\frac{2}{3}$ Ni we get the scale of Janya Thata '**Yaman**'. 4 Ragas are grouped under this Janya Thata. The scale will be as follows:—

Swaras— **Sa**, **Ri**, **Ga**, S-Ma, **Pa**, Dha, S-Ni, **Ṡa**.
Vibrations—240, 270, 300, $341\frac{1}{3}$, 360, 400, $455\frac{1}{9}$, 480.

The scale of **Yaman Thata** of modern authors, based on their incomplete scale of 12 Semi-tones, is as follows:—

Swaras— **Sa**, **Ri**, **Ga**, Ma, **Pa**, **Dha**, **Ni**, **Ṡa**.
Vibrations—240, 270, 300, $337\frac{1}{2}$, 360, 405, 450, 480.

In this scale three notes **Ma**, **Dha** and **Ni** will be found inaccurate on comparison with those played by all musicians on the fixed frets of Veena, Sitar, Dilruba, etc., as shown above in the scale of Janya Thata '**Yaman**'.

As every musician knows, by omitting two notes **Ma** and **Ni** from Yaman Thata we get the scale of **Bhup Raga** of five notes having the note **Ga** as Vadi and **Dha** as its Samvadi. Now in the above scale of modern authors there is no samvadi relationship between 300 **Ga** and 405 **Dha**. For samvadi relationship with 300 **Ga** the vibrations of **Dha** (the fourth) must be $300\times\frac{4}{3}=400$. This also goes to prove without any doubt that the above scale of **Yaman Thata** of modern authors is incorrect.

(2) By omitting $341\frac{1}{3}$ S-Ma and $426\frac{2}{3}$ Ni we get the scale of Janya Thata '**Shuddha Bilaval**'. 12 Ragas are grouped under this Janya Thata. The scale will be as follows :—

Swaras— **Sa**, **Ri**, **Ga**, **Ma**, **Pa**, Dha, S-Ni, **Ṡa**.
Vibrations—240, 270, 300, 320, 360, 400, $455\frac{1}{9}$, 480.

The scale of **Bilaval Raga** of modern authors, based on their incomplete scale of 12 Semi-tones, is as follows :—

Swaras— **Sa**, **Ri**, **Ga**, Ma, **Pa**. **Dha**, **Ni**, **Ṡa**.
Vibrations—240, 270, 300, 320, 360, 405, 450, 480.

This is our modern fundamental scale of Sa-Grama, played on Sa-wire from the 'Mairu'. In this scale two notes **Dha** and **Ni** will be found inaccurate on comparison with those played by all students **as their primary lesson** on the fixed frets of Veena, Sitar, Dilruba, etc., on **Ma**-wire from the seventh fret (tonic **Sa**), as shown above in the correct scale of Janya Thata '**Shuddha Bilaval**'.

In **Bilaval Raga** the note **Dha** is Vadi and **Ga** its Samvadi. As already explained in **Yaman Thata** of modern authors there cannot be samvadi relationship between 300 **Ga** and 405 **Dha** or vice versa. This is a clear proof that our modern fundamental scale cannot correspond with **Bilaval Raga** according to the whims of modern authors. It is identical with our **Shankra** and **Bihaga** Ragas as will be quite evident from the next chapter.

According to the opinion of some authors our **Ma-Grama** scale, which is identical with the Western Major Scale, corresponds with **Bilaval Raga**. This scale is as follows :—

Swaras—**Sa**, **Ri**, **Ga**, Ma, **Pa**, Dha, **Ni**, **Ṡa**.
Vibrations—240, 270, 300, 320, 360, 400, 450, 480.
(see page 30)

In this scale there is samvadi relationship between **Ga** and **Dha** as well as **Ni**. In **Bilaval Raga** the note **Ni** has no prominence whatsoever. In fact it is a **Vivadi** swara, hence being alien to harmony, there cannot be concordant relationship between **Ga** and **Ni** in Bilaval Raga. This goes to prove that the note **Ni** is not correct in the above scale. It ought to be 455⅑ S-Ni **as played daily by all performers on stringed instruments.**

It will not be out of place to mention here that the author of this treatise has interpreted nothing by **mere assumptions** like some of the past and present scholars, but every existing fallacy is clearly exposed in this treatise by **solid facts and figures** for the benefit of students with a view to arrest further decay of this noble heritage.

It should be particularly borne in mind that it is only the **Murchanas** that determine the Raga-scales on stringed instruments. Raga-scales advocated by modern authors, **being simply imaginary**, are incorrect and misleading to the students of Indian music. Accurate Raga-scales demand a deep study of the traditional **Murchanas** as well as a genuine practical knowledge of the accurate pitch of the **Raga Notes** that are produced on stringed instruments.

(3) By omitting 341⅓ S-Ma and 455⅑ S-Ni we get the scale of Janya Thata '**Kamboji**'. 2 Ragas are grouped under this Janya Thata.

By omitting 320 $\underline{\text{Ma}}$ and 455⅑ S-Ni we get the fourth Janya Thata. This Thata, being unsuitable to our Ragas, is discarded.

Thus out of eight Janya Thatas of Janak Thata '**Kedara**', only five aforesaid Janya Thatas are made use of for the classification of Ragas.

In all about 50 Ragas are grouped under the Janak Thata '**Kedara**' and its five Janya Thatas.

☞ Scales of all the Janak and Janya Thatas, as well as the names of all the Ragas that are grouped under these Thatas are given with their accurate Vadi and Samvadi swaras in the chart of Raga-classification at the end of this treatise.

Note—Some scholars opine that **Yaman Kalyan Raga** uses **Atikomal** Ma. As every musician knows, Komal Madhyama swara has no prominence whatever in **Yaman Kalyan Raga**, hence the use of either Komal or Atikomal Madhyama swara in the said Raga will have no detrimental effect on it whatsoever. The same may be safely said about **Dhaivata** swara of **Bihaga** and **Shankra** Ragas, also of all the varieties of **Sarang** and **Kanada** Ragas.

CHAPTER IV.

(2) Shuddha Antar 'Rajani' Murchana of Sa-Grama. Modern Name—Thata 'Bihaga'.

Shuddha Kakli-Antar **'Rajani'** Murchana is the second Murchana of Sa-Grama, developed by shifting the tonic **Sa** to **Ni** of the Shuddha Kakli-Antar scale of Sa-Grama. This is our modern fundamental scale including Bharata's Kakli **Ni** and Antar-Ga (see Chart No. 3 of Part I). It runs as under :—

Murchana—Ni, 2 K-Ni, 2 Sa, 3 Ri, 2Ga, 2A-Ga, 2Ma, 4 Pa, 3 Dha, 2Ni.
Scale—**Sa**, 2 Ri, 2 **Ri**, 3 **Ga**, 2 **Ma**, 2 S-Ma, 2 **Pa**, 4 **Dha**, 3**Ni**, 2 **Ṡa**.
Shruti Nos.— 2 4 7 9 11 13 17 20 22
Vibrations—240, 256, 270, 300, 320, 341⅓, 360, 405, 450, 480.
Frac: Ratios — $\frac{16}{15} \times \frac{135}{128} \times \frac{10}{9} \times \frac{16}{15} \times \frac{16}{15} \times \frac{135}{128} \times \frac{9}{8} \times \frac{10}{9} \times \frac{16}{15} = 2$

Samvadi Relationship of Swaras.

Notes—Sa, Ri, **Ri**, **Ga**, **Ma**, S-Ma, **Pa**, **Dha**, **Ni**.
(**Ma**)—**Ma**, S-Ma, **Pa**, 0, 0, 0, **Sa**, **Ri**, **Ga**.
(**Pa**)—**Pa**, 0, **Dha**, **Ni**, **Sa**, Ri, **Ri**, 0, 0.

There is no Raga of nine swaras of the above scale. By omitting 256 Ri, i. e. Kakli-Ni, we get the scale of

Shuddha Antar 'Rajani' Murchana of Sa-Grama. This scale of eight swaras will correspond with the scale of modern **Bihaga Raga** having two varieties of Madhyama swara.

In **Bihaga Raga Ga** is Vadi and **Ni** Samvadi. The vibrations of **Ni** are 450 in this scale.

By omitting 320 $\underline{\textbf{Ma}}$ (or sometimes both the Madhyama swaras) from the **Bihaga** scale we get the scale of modern **Shankra Raga.**

Bihaga and **Shankra** are the only two Ragas that can be grouped under the above Murchana.

Remember that our modern fundamental scale of seven shuddha swaras, which is the scale of Sa-wire from mairu (nut), is the traditional second **Shuddha 'Rajani' Murchana** of Sa-Grama, which corresponds with the scale of our modern **Bihaga** and **Shankra** Ragas and not **Bilaval Raga,** as fully explained in the previous chapter.

Musicians generally play **Bihaga** and **Shankra** Ragas on the fixed frets of the stringed instruments. As there is a minute difference between 400 Dha and 405 **Dha**, similarly between 450 **Ni** and 455⅑ S-Ni, the difference in the pitch of these notes is not perceptible by ordinary ears.

As every musician knows, the note **Dha** has no prominence in **Bihaga** and **Shankra** Ragas, hence the difference in pitch of this note (400 or 405) does not affect these Ragas in any way. The two notes **Ga** and **Ni** are very prominent in both the Ragas, hence it is absolutely essential that the accurate note 450 **Ni**, which is little lower than 455⅑ S-Ni, should be used to maintain the samvadi relationship between the notes **Ga** and **Ni** of these Ragas. Should 455⅑ S-Ni be used in **Bihaga Raga** according to the opinion of some scholars, it would be advisable to group it under the scale of **Shuddha Kalyan Thata** given on page 80, and fix **Sa** as Vadi and **Pa** as its Samvadi swara. As the note **Dha** has no prominence in **Bihaga Raga,** it cannot be a **Samvadi** swara, although there is samvadi relationship between 300 **Ga** and 400 Dha in the scale of **Shuddha Kalyan Thata.**

In **Bihaga** and **Shankra** Ragas the note $341\frac{1}{3}$ S-Ma is simply an ornamental note as these Ragas can be played and sung even without it. It is just like a Vivadi swara having no prominence. It should be borne in mind that music, formed of consonant chords only, would be extremely monotonous and quite without vigour; hence to acquire greater vigour and strength in the expression of their ideas, musicians are obliged to have recourse to dissonant (Vivadi) notes and chords. Truly speaking, much greater satisfaction is felt when a dissonant chord is resolved into a consonant chord than when nothing but consonant chord has been heard. It is the force of contrast which produces these sensations in us, just as we doubly appreciate a calm after a storm. This is exactly the idea which has unconsciously guided music upto our time. Its strength lies in dissonances, if they do not last too long and they be at last resolved into consonant chords.

CHAPTER V

(3) Shuddha 'Souviri' Murchana of Ma-Grama. Modern Name-Raga 'Deshkar'.

This scale is the first Murchana of **Ma-Grama**, which starts from the note **Ma**. By shifting the tonic **Sa** to **Ma** of the Shuddha scale of Ma-Grama, the scale will be as follows. In Ma-Grama **Pa** is Trishrutik and **Dha** Chatushrutik i. e. the reverse of Sa-Grama, thus

Murchana—	Ma,	3 Pa,	4 Dha,	2 Ni,	4 Sa,	3 Ri,	2 Ga,	4 Ma.
Scale—	**Sa**,	3 Ri,	4 **Ga**,	2 $\underline{\textbf{Ma}}$.	4 **Pa**,	3 Dha,	2 $\underline{\underline{\text{Ni}}}$,	4 $\dot{\textbf{Sa}}$.
Shruti Nos.—		3	7	9	13	16	18	22
Vibrations—	240,	$266\frac{2}{3}$,	300,	320,	360,	400,	$426\frac{2}{3}$,	480.
Frac: Ratios—		$\frac{10}{9}$	$\times \frac{9}{8}$	$\times \frac{16}{15}$	$\times \frac{9}{8}$	$\times \frac{10}{9}$	$\times \frac{16}{15}$	$\times \frac{9}{8} = 2$

Samvadi Relationship of Swaras.

Notes—	Sa,	Ri,	Ga,	Ma,	Pa,	Dha,	Ni.
(Ma)—	Ma,	0,	Dha,	Ni,	Sa,	Ri,	0.
(Pa)—	Pa,	Dha,	0,	Sa,	0,	Ga,	Ma.

There is no Raga of seven swaras of the above scale. By omitting two notes 320 **Ma** and $426\frac{2}{3}$ Ni we get the scale of five notes of the modern **Deshkar Raga.**

In Deshkar Raga Dha is Vadi and Ri as well as **Ga** are Samvadi swaras, as will be seen from the above chart. The five notes of this Deshkar Raga are practically the same as those of **Bhup Raga** of **Yaman Thata** with a little difference of one shruti in the note **Ri.** As already stated in chapter III of this part Bhup Raga uses 270 Chatushrutik **Ri,** hence there is samvadi relationship between 300 **Ga** and 400 Dha only.

The following is the answer to the question that may naturally be asked why **Deshkar Raga** uses $226\frac{2}{3}$ Trishrutik Ri. As every musician knows, **Deshkar Raga** corresponds with the shastrya **Bibhas Raga** of **Bhairava Thata,** hence among musicians this Deshkar Raga is also well known as Bibhas Raga. This Bibhas Raga uses $379\frac{1}{16}$ Atikomal Dha which is Vadi and $253\frac{1}{8}$ Atikomal Ri which is Samvadi, as will be seen later on in chapter XIV from the scale of Bhairava Thata. Consequently to maintain the same concordant relationship in Deshkar Raga also, $266\frac{2}{3}$ Ri (Samvadi) is used with 400 Dha (Vadi).

Musicians generally play **Deshkar Raga** on the fixed frets of the stringed instruments which have 270 Chatushrutik **Ri.** The minute difference of one shruti is not perceptible by ordinary ears; moreover it does not affect the emotion of the Raga in any way.

$266\frac{2}{3}$ Trishrutik Ri is used only in **Deshkar** and **Bageshri** Ragas. It is generally omitted in the 'aroha' (ascent). All other Ragas use 270 Chatushrutik **Ri,** which is fixed on stringed instruments.

This modern Deshkar Raga evolves out of the traditional very first Murchana of **Ma-Grama.** It will also be evident from subsequent chapters that many Ragas of **Ma-Grama** are sung and played to-day by our musicians. This is a clear proof that the traditional **Ma-Grama** is in vogue in our modern music also, having **Sa** as a **Common Tonic** for the scale of both the Gramas, as already stated in chapter IV of Part I. Thus, the term '**Grama**' has now dropped out in our modern music.

It, therefore, shows total lack of knowledge of the traditional Gramas and Murchanas to advocate that **Ma-Grama** has passed away into oblivion and as such is not in vogue in modern music.

CHAPTER VI.

(4) Shuddha 'Uttarmandra' Murchana of Sa-Grama. Modern Name–Raga 'Bageshri'.

This is the first Murchana, the fundamental Shuddha scale of Sa-Grama of Bharata. It runs as follows :—

Scale—	**Sa,**	3 Ri,	2 $\underline{\underline{\text{Ga}}}$,	4 $\underline{\textbf{Ma}}$,	4 **Pa,**	3 Dha,	2 $\underline{\underline{\text{Ni}}}$,	4 **Ṡa.**
Shruti Nos.—		3	5	9	13	16	18	22
Vibrations—	240,	$266\frac{2}{3}$,	$284\frac{4}{9}$,	320,	360,	400,	$426\frac{2}{3}$,	480.

Frac. Ratios— $\frac{10}{9} \times \frac{16}{15} \times \frac{9}{8} \times \frac{9}{8} \times \frac{10}{9} \times \frac{16}{15} \times \frac{9}{8} = 2$

Samvadi Relationship of Swaras.

Notes—	**Sa,**	Ri,	$\underline{\underline{\text{Ga}}}$,	$\underline{\textbf{Ma}}$,	**Pa,**	Dha,	$\underline{\underline{\text{Ni}}}$.
($\underline{\textbf{Ma}}$)—	$\underline{\textbf{Ma}}$,	0,	0,	$\underline{\underline{\text{Ni}}}$,	**Sa,**	Ri,	$\underline{\underline{\text{Ga}}}$.
(**Pa**)—	**Pa,**	Dha,	$\underline{\underline{\text{Ni}}}$,	**Sa,**	0,	0,	$\underline{\textbf{Ma}}$.

The above scale corresponds with the modern **Bageshri Raga.** In **Bageshri** scale $284\frac{4}{9}$ $\underline{\underline{\text{Ga}}}$ and $426\frac{2}{3}$ $\underline{\underline{\text{Ni}}}$ are **Atikomal** swaras.

Some authors have erroneously stated that this traditional fundamental scale of our shastra-writers corresponds with the scale of modern **Kafi Raga.** As will be seen later on in chapter IX, when **Sa, Ma** and **Pa** these three notes of the ancient Shuddha scale of Sa-Grama become **Chute** or **Laghu,** then only we get the scale of the modern **Shuddha Kafi Raga.** It can also be developed from the ancient Shuddha Kakli-Antar '**Kalopanta**' Murchana of Ma-Grama, as will be seen in the next chapter.

As every musician knows, in **Kafi Raga Pa** is Vadi and **Ri** Samvadi, while in the above traditional fundamental scale there is no samvadi relationship between $266\frac{2}{3}$ Trishrutik Ri and 360 Chatushrutik **Pa ;** hence it goes to prove without any doubt that this traditional fundamental scale of seven Shuddha swaras does not correspond with the modern **Kafi Raga.** As will be seen later on, both the scales of **Bageshri** and **Kafi Raga** vary considerably. It is also incorrect to group **Bageshri Raga** under **Kafi Thata.**

Bageshri Raga has 'karuna rasa' (compassion sentiment), hence **Atikomal** $284\frac{4}{9}$ $\underline{\underline{\text{Ga}}}$ and $426\frac{2}{3}$ $\underline{\underline{\text{Ni}}}$ are used in this Raga. **Kafi Raga** has 'shrangar rasa' (love sentiment), hence **Komal** 288 $\underline{\text{Ga}}$ and 432 $\underline{\text{Ni}}$ are used in this Raga. As a rule **Atikomal swaras** are used in all the Ragas having 'karuna rasa', such as all Ragas of **Asavari, Toadi, Bhairava,** etc., Thatas, as will be seen later on.

It should be particularly borne in mind that although there is very little difference in the pitch of Atikomal and Komal swaras, they play a most important part in expressing different emotions of Ragas, hence it is absolutely essential to use **only the prescribed Shruti-swaras** in the Ragas using **Atikomal** or **Komal** swaras as the case may be.

In **Bageshri** scale the vibrations of the note Ri are $266\frac{2}{3}$ i. e. it is Trishrutik, hence it stands in samvadi relationship with 400 Trishrutik Dha. If there be 270 Chatushrutik **Ri,** there will be no note in the scale that will be in samvadi relationship with 400 Trishrutik Dha and consequently there will be a breach of the prescribed rule of the Thatas. As every musician knows, in **Bageshri** Raga the note **Ri** has no prominence in the 'arohi' (ascent), hence the use of 270 Chatushrutik **Ri** (which is a fixed note on the fret) in the 'avarohi' (descent) instead of $266\frac{2}{3}$ Trishrutik Ri of the scale will not affect the Raga in any way. This Raga is played on the fixed frets of the stringed instruments.

By adding Antar-Ga i. e. modern ($284\frac{4}{9} \times \frac{16}{15}$) $303\frac{11}{27}$ S-Ga in **Bageshri** scale we get the scale of '**Malgunji**' **Raga.** This Raga is not very popular at present.

The relations of the constituent Shuddha and Kakli-Antar notes of Bharata's fundamental scale can be represented thus,

Scale—Sa, 3 Ri, 2 $\underline{\underline{\text{Ga}}}$, 2 S-Ga, 2 $\underline{\textbf{Ma}}$, 4 **Pa**, 3 Dha, 2 $\underline{\underline{\text{Ni}}}$, 2S-Ni, 2$\dot{\text{S}}$a

Shuti Nos.— 3 5 7 9 13 16 18 20 22

Vibrations—240, 270, $284\frac{4}{9}$, $303\frac{11}{27}$, 320, 360, 400, $426\frac{2}{3}$, $455\frac{1}{9}$, 480.

Frac: Ratios— $\frac{10}{9} \times \frac{16}{15} \times \frac{16}{15} \times \frac{135}{128} \times \frac{9}{8} \times \frac{10}{9} \times \frac{16}{15} \times \frac{16}{15} \times \frac{135}{128} = 2$

In this traditional scale Antar-Ga and Kakli-Ni are the modern S-Ga and Sa-Ni, and as such, their vibrations are $303\frac{11}{27}$ and $455\frac{1}{9}$ respectively, as will be evident from the above chart. Antar-Ga i. e. the modern $303\frac{11}{27}$ S-Ga is the **augmented** or **sharpened third** i. e. it is 20 cents more than the prime 300 **Ga.** Both the sharpened $303\frac{11}{27}$ S-Ga and the prime 300 **Ga** are counted as **seven** Shrutis from the modern tonic **Sa** and assume only **one Shruti-name** according to the traditional shastric rule of '**Shruti Satharan Prakar**' (see page 36). Similarly the traditional Kakli-Ni i. e. the modern $455\frac{1}{9}$ S-Ni is the **sharpened seventh** i. e. it is more than 20 cents than the prime 450 **Ni.** As aforesaid both the sharpened $455\frac{1}{9}$ S-Ni and the prime 450 **Ni** are counted as **twenty** Shrutis from the modern tonic **Sa** and assume only **one Shruti-name** thus,

		(Avikrit)				
Swaras—	Ga,	2 S-Ga,	2 **Ma.**	Ga,	2 **Ga,**	2 **Ma.**
Shruti Nos.—	5	7	9	5	7	9
Vibrations—	$284\frac{4}{9}$,	$303\frac{11}{27}$,	320	$284\frac{4}{9}$,	300,	320
Frac: Ratios—	$\frac{16}{15} \times \frac{135}{128} = \frac{9}{8}$			$\frac{135}{128} \times \frac{16}{15} = \frac{9}{8}$		

		(Avikrit)				
Swaras—	Ni,	2 S-Ni,	2 **Ṡa.**	Ni.	2 **Ni,**	2 **Ṡa.**
Shruti Nos.—	18	20	22	18	20	22
Vibrations—	$426\frac{2}{3}$,	$455\frac{1}{9}$,	480	$426\frac{2}{3}$,	450,	480
Frac: Ratios—	$\frac{16}{15} \times \frac{135}{128} = \frac{9}{8}$			$\frac{135}{128} \times \frac{16}{15} = \frac{9}{8}$		

It should be particularly borne in mind that although the vibrations of the traditional Antar-Ga and Kakli-Ni can occasionally be 300 and 450 respectively, their vibrations in the above fundamental scale of Bharata are always $303\frac{11}{27}$ and $455\frac{1}{9}$, and not 300 and 450 respectively. As already stated in chapter III of this second Part, in Bharata's fundamental scale the interval between Shuddha **Ga** and Antar-Ga, similarly between Shuddha **Ni** and Kakli-Ni is $\frac{16}{15}$ i. e. **Dwishrutik** (see charts No. 10 and 11). Owing to this Dwishruti Antar the interval between Antar-Ga and **Ma**, similarly between Kakli-Ni and **Sa** is $\frac{135}{128}$ i. e. **Laghu-Dwishrutik.** On account of this smallest interval of **Laghu-Dwishruti** in the traditional fundamental scale, the two notes **Sa** and **Ma** were '**avikrit**' (stationary) in ancient music (see the above illustrations).

CHAPTER VII.

(5) Shuddha Kakli-Antar 'Kalopanta' Murchana of Ma-Grama. Modern name-Janak Thata 'Sindh Bhairavi'.

This is the third Murchana of **Ma-Grama**, developed by shifting the tonic **Sa** to **Ri** of the Shuddha Kakli-Antar scale of Ma-Grama, thus

Murchana—	Ri,	2Ga,	2A-Ga,	2Ma,	3 Pa,	4 Dha,	2Ni,	2K-Ni,	2Sa,	3 Ri.
Scale—	**Sa**,	2 Ri,	2 **Ri**,	2 Ga,	3**Ma**,	4 **Pa**,	2Dha,	2 **Dha**,	2 Ni,	3 **Ṡa**.
Shruti Nos.—		2	4	6	9	13	15	17	19	22
Vibrations—	240,	256,	270,	288,	320,	360,	384,	405,	432,	480.

Frac. Ratios— $\frac{16}{15} \times \frac{135}{128} \times \frac{16}{15} \times \frac{10}{9} \times \frac{9}{8} \times \frac{16}{15} \times \frac{135}{128} \times \frac{16}{15} \times \frac{10}{9} = 2$

Samvadi Relationship of Swaras.

Notes—	**Sa**,	Ri,	**Ri**,	Ga,	**Ma**,	**Pa**,	Dha,	**Dha**,	Ni.
(**Ma**)—	**Ma**,	0,	**Pa**,	Dha,	0,	**Sa**,	Ri,	**Ri**,	Ga.
(**Pa**)—	**Pa**,	Dha,	**Dha**,	Ni,	**Sa**,	**Ri**,	Ga,	0,	0.

In the above scale 256 Ri, 288 Ga, 384 Dha and 432 Ni are all **komal** swaras. This scale of nine swaras corresponds with the scale of our modern **'Sindh Bhairavi Raga'**, hence it is called **Janak Thata 'Sindh Bhairavi'.**

Out of the eight Janya Thatas of the Janak Thata **'Sindh Bhairavi'**, three Janya Thatas are used in our Ragas, namely **Shuddha Bhairavi, Darbari** and **Shuddha Kafi**. They are developed from the Janak Thata as under :—

(1) By omitting 270 **Ri** and 405 **Dha** we get the scale of Janya Thata '**Shuddha Bhairavi**'. 3 Ragas are grouped under this Janya Thata.

(2) By omitting 256 $\underline{\text{Ri}}$ and 405 **Dha** we get the scale of Janya Thata '**Darbari**'. 5 Ragas are grouped under this Janya Thata.

(3) By omitting 256 $\underline{\text{Ri}}$ and 384 $\underline{\text{Dha}}$ we get the scale of Janya Thata '**Shuddha Kafi**'. Full details are given later on in chapter IX.

In all 9 Ragas are grouped under the Janak Thata '**Sindh Bhairavi**' and its two Janya Thatas '**Shuddha Bhairavi**' and '**Darbari**'.

CHAPTER VIII

(6) Shuddha Kakli-Antar 'Ashvakranta'

300 Antar Murchana of Sa-Grama.

Modern Name-Thata 'Multani'.

In Bharata's fundamental Shuddha Kakli-Antar scale the vibrations of Antar-Ga can occasionally be 303$\frac{1}{7}$ or 300 as already stated in chapter VI.

The above Murchana is the sixth Murchana of Sa-Grama. It is developed by shifting the tonic **Sa** to 300 **Antar-Ga** of the Shuddha Kakli-Antar scale of Sa-Grama, thus

Murchana—	A-Ga,	2Ma,	4Pa,	3Dha,	2Ni,	2K-Ni,	2Sa,	3Ri,	2Ga,	2A-Ga
Scale—	**Sa**,	2 $\underline{\text{Ri}}$,	4$\underline{\text{Ga}}$,	3 $\underline{\textbf{Ma}}$,	2S-Ma,	2 **Pa**,	2 $\underline{\text{Dha}}$,	3$\underline{\underline{\text{Ni}}}$,	2S-Ni,	2 $\dot{\textbf{Sa}}$.
Shruti Nos.—		2	6	9	11	13	15	18	20	22
Vibrations—	240,	256,	288,	320,	341$\frac{1}{3}$,	360,	384,	426$\frac{2}{3}$,	455$\frac{1}{9}$,	480.
Frac: Ratios—		$\frac{16}{15}$ ×	$\frac{9}{8}$ ×	$\frac{10}{9}$ ×	$\frac{16}{15}$ ×	$\frac{135}{128}$ ×	$\frac{16}{15}$ ×	$\frac{10}{9}$ ×	$\frac{16}{15}$ ×	$\frac{135}{128}$ = 2

Samvadi Relationship of Swaras.

Notes—	Sa,	$\underline{\text{Ri}}$.	$\underline{\text{Ga}}$,	$\underline{\textbf{Ma}}$,	S-Ma,	**Pa**,	$\underline{\text{Dha}}$,	$\underline{\underline{\text{Ni}}}$,	S-Ni.
(**$\underline{\textbf{Ma}}$**)—	$\underline{\textbf{Ma}}$,	S-Ma,	$\underline{\text{Dha}}$,	$\underline{\underline{\text{Ni}}}$,	S-Ni,	**Sa**,	$\underline{\text{Ri}}$,	0,	0.
(**Pa**)—	**Pa**,	$\underline{\text{Dha}}$,	0,	**Sa**,	$\underline{\text{Ri}}$,	0,	$\underline{\text{Ga}}$,	$\underline{\textbf{Ma}}$,	S-Ma.

The above scale of nine swaras is not used in any of our Ragas. By omitting 320 **Ma** and 426⅔ Ni, we get the scale of our modern Thata '**Multani**'.

In '**Multani**' Raga Ri, Ga and Dha are **Komal** swaras. It is, therefore, incorrect to group this Raga under **Toadi Thata** which uses **Atikomal** Ri, Ga and Dha, as will be seen later on in chapter XII.

Only 2 Ragas are grouped under '**Multani**' **Thata**, namely **Multani** and **Utri Basant**.

Here ends the full description of the traditional six Shuddha Kakli-Antar Murchanas of both the Gramas that are used in our modern Thatas and Ragas.

Besides these six Murchanas, three Murchanas of **Laghu Sa, Ma, Pa Scale** are also used in our modern Thatas and Ragas. Full description of these three Murchanas are given in subsequent chapters.

CHAPTER IX.

Chute or Laghu Sa, Ma, Pa Murchanas.

Besides the varieties of 64 Murchanas stated in chapter 1 of this second Part there are also **Chute** or **Laghu Sa, Ma, Pa Murchanas.** In Bharata's fundamental scale of seven Shuddha swaras **Sa**, **Ma** and **Pa** these three swaras have four shrutis each. When they stand on their penultimate i. e. third shruti, they are called **Laghu Sa**, **Laghu Ma**, and **Laghu Pa**. The scale of **Laghu Sa**, **Ma** and **Pa** is formed in the following way.

Bharata's Shuddha Scale of Sa-Grama.

Sa, 3 **Ri**, 2 **Ga**, 4 **Ma**, 4 **Pa**, 3 **Dha**, 2 **Ni**, 4 **Ṡa**.

As already stated in chapter IV of Part I, when chatushrutik **Pa** of Sa-Grama stands on its third shruti we get the scale of **Ma-Grama.** This Ma-Grama scale will, therefore, be the scale of **Laghu Pa**, thus

Scale of Laghu Pa.

Sa, 3 **Ri**, 2 **Ga**, 4 **Ma**, 3 **Pa**, 4 **Dha**, 2 **Ni**, 4 **Ṡa.**

As **Pa** is reduced one shruti in Ma-Grama scale, the said shruti is taken over by its succeeding note **Dha**, hence the latter becomes chatushrutik in Ma-Grama.

When chatushrutik **Sa** of **Laghu Pa** scale stands on its third shruti, the scale of **Laghu Sa** and **Pa** will be as follows :-

Scale of Laghu Sa and Pa.

Sa, 4 **Ri**, 2 **Ga**, 4 **Ma**, 3 **Pa**, 4 **Dha**, 2 **Ni**, 3 **Ṡa.**

As **Sa** is reduced one shruti in this scale, the said shruti is taken over by its succeeding note **Ri**, hence the latter becomes chatushrutik in this **Laghu Sa, Pa** scale.

When chatushrutik **Ma** of the above **Laghu Sa, Pa** scale stands on its third shruti, the scale of **Laghu Sa, Ma** and **Pa** will be as under :—

Scale of Laghu Sa, Ma and Pa.
(Modern 'Shuddha Kafi' Scale.)

Scale—	**Sa**,	4 **Ri**,	2 $\underline{\text{Ga}}$,	3 $\underline{\text{Ma}}$,	4 **Pa**,	4 **Dha**,	2 $\underline{\text{Ni}}$,	3 **Ṡa.**
Shruti Nos.—		4	6	9	13	17	19	22
Vibrations—	240,	270,	288,	320,	360,	405,	432,	480.
Frac: Ratios—		$\frac{9}{8}$ ×	$\frac{16}{15}$ ×	$\frac{10}{9}$ ×	$\frac{9}{8}$ ×	$\frac{9}{8}$ ×	$\frac{16}{15}$ ×	$\frac{10}{9}=2.$

Note—On comparison with the '**Bageshri**' scale of chapter VI it will be clearly seen that almost all the notes of both the scales vary considerably.

As **Ma** is reduced one shruti in this scale, the said shruti is taken over by its succeeding note **Pa**, hence the latter becomes chatushrutik in this **Laghu Sa, Ma, Pa** scale.

As Bharata's fundamental scale is called the first **'Uttarmandra'** Murchana, this scale is called **Laghu Sa, Ma, Pa 'Uttarmandra' Murchana.** This traditional scale corresponds with the scale of our modern **'Shuddha Kafi' Raga.**

By including Antar-Gandhara and Kakli-Nishada in this scale we get the scale of **Laghu Sa, Ma, Pa Kakli-Antar 'Uttarmandra' Murchana** of nine swaras, thus

			3 shrutis					3 shrutis		
Scale—	**Sa,**	4 **Ri,**	2 Ga,	S-Ga,	**Ma,**	4 **Pa,**	4 **Dha,**	2 Ni,	S-Ni,	**Ṡa.**
Shruti Nos.—		4	6	7	9	13	17	19	20	22
Vibrations—	240,	270,	288,	$303\frac{11}{27}$,	320,	360,	405,	432,	$455\frac{1}{9}$,	480
Frac. Ratios—		$\frac{9}{8}$ ×	$\frac{16}{15}$ ×	$\frac{256}{243}$ ×	$\frac{135}{128}$ ×	$\frac{9}{8}$ ×	$\frac{9}{8}$ ×	$\frac{16}{15}$ ×	$\frac{256}{243}$ ×	$\frac{135}{128} = 2$

Antar-Ga is S-Ga and Kakli-Ni is S-Ni in the modern scale.

In this scale of nine swaras there are two kinds of **Gandhara** and **Nishada** swaras. Among Ragas using two kinds of Gandhara and Nishada swaras the prominent Raga is **'Sindh Kafi'**, hence the above ancient scale of **Laghu Sa, Ma, Pa, Kakli-Antar 'Uttarmanda' Murchana** is called the modern **Janak Thata 'Sindh Kafi'.**

Full details of this **Janak Thata 'Sindh Kafi'** are given in the next chapter.

By shifting the tonic **Sa** as usual to each note of the aforesaid **Laghu Sa, Ma, Pa Kakli-Antar 'Uttarmandra' Murchana** of nine swaras we get the remaining eight varieties of Kakli-Antar Murchanas of this scale, out of which only two Murchanas are suitable to our Ragas. A detailed description of these two Kakli-Antar Murchanas is given later on in chapter XI and XII.

Note—This scale has been very lucidly explained by Bharata and Sarangdeva in the chapter of **'Shruti Satharana. Swara Satharana, Grama Satharana,** etc.

CHAPTER X

(7) Laghu Sa, Ma, Pa Kakli-Antar 'Uttarmandra' Murchana, Modern Name—Janak Thata 'Sindh Kafi'.

As stated in the previous chapter the scale of **Laghu Sa, Ma, Pa Kakli-Antar 'Uttarmandra' Murchana** i. e. Modern **Janak Thata 'Sindh Kafi'** runs as under :—

3 shrutis (2 Ga — Ma)   3 shrutis (2 Ni — Sa)

Sa, 4 **Ri**, 2 $\underline{\text{Ga}}$, S-Ga, $\underline{\textbf{Ma}}$, 4 **Pa**, 4 **Dha**, 2 $\underline{\text{Ni}}$, S-Ni, $\dot{\textbf{Sa}}$.

240, 270, 288, $303\frac{11}{27}$, 320, 360, 405, 432, $455\frac{1}{9}$, 480.

Samvadi Relationship of Swaras.

Notes—	Sa,	Ri,	$\underline{\text{Ga}}$,	S-Ga,	$\underline{\text{Ma}}$,	Pa,	Dha,	$\underline{\text{Ni}}$,	S-Ni.
($\underline{\text{Ma}}$)—	$\underline{\text{Ma}}$,	Pa,	0,	0,	0,	Sa,	Ri,	$\underline{\text{Ga}}$.	S-Ga.
($\underline{\text{Pa}}$)—	Pa,	Dha,	$\underline{\text{Ni}}$.	S-Ni,	Sa,	Ri,	0,	0,	0.

18 Ragas are grouped under this Janak Thata '**Sindh Kafi**'.

Out of the eight Janya Thatas of the Janak Thata '**Sindh Kafi**', two Janya Thatas are used in our Ragas, namely '**Kanada**' and '**Shuddha Kafi**'. They are developed from the Janak Thata as under :—

(1) By omitting $303\frac{11}{27}$ S-Ga we get the scale of the Janya Thata '**Kanada**'. 21 Ragas are grouped under this Janya Thata.

(2) By omitting $303\frac{11}{27}$ S-Ga and $455\frac{1}{9}$ S-Ni we get the scale of the Janya Thata '**Shuddha Kafi**', as already stated in chapter VIII. 4 Ragas are grouped under this Janya Thata.

In all 43 Ragas are grouped under the Janak Thata '**Sindh Kafi**' and its two Janya Thatas.

Note—$303\frac{11}{27}$ S-Ga, which is a sharpened third, is used in this scale. The use of 300 **Ga** will not affect the Ragas grouped under '**Sindh Kafi' Thata** in any way. 300 **Ga** is generally used in these Ragas in the 'avarohi' (descent).

CHAPTER XI.

(8) Laghu Sa, Ma, Pa Kakli-Antar 'Uttarayata' Murchana, Modern Name-Thata 'Asavari'.

'Uttarayata' Murchana is the third Murchana of Sa-*Grama starting from the note* **Dha.** *By shifting the tonic* **Sa** to **Dha** of **Laghu Sa, Ma, Pa Kakli-Antar** scale, we get the scale of **Laghu Sa, Ma, Pa Kakli-Antar 'Uttarayata' Murchana**, thus

Murchana— Dha, 2 $\overbrace{\text{Ni, K-Ni, Sa}}^{3}$, 4Ri, 2 $\overbrace{\text{Ga, A-Ga, Ma}}^{3}$, 4 Pa, 4 Dha.

Scale—	**Sa,**	2 $\underline{\text{Ri}}$,	**Ri,**	$\underline{\underline{\text{Ga}}}$,	4 $\underline{\textbf{Ma}}$,	2S-Ma,	**Pa.**	$\underline{\underline{\text{Dha}}}$,	4$\underline{\underline{\text{Ni}}}$,	4 $\dot{\textbf{Sa}}$.
Shruti Nos.—		2	4	5	9	11	13	14	18	22
Vibrations—	240,	256,	270,	$284\frac{4}{9}$,	320,	$341\frac{1}{3}$,	360,	$379\frac{7}{27}$,	$426\frac{2}{3}$,	480.

Frac: Ratios— $\frac{16}{15} \times \frac{135}{128} \times \frac{256}{243} \times \frac{9}{8} \times \frac{16}{15} \times \frac{135}{128} \times \frac{256}{243} \times \frac{9}{8} \times \frac{9}{8} = 2$

Samvadi Relationship of Swaras.

Notes—	**Sa,**	$\underline{\text{Ri}}$.	**Ri,**	$\underline{\underline{\text{Ga}}}$,	$\underline{\textbf{Ma}}$,	S-Ma,	**Pa,**	$\underline{\underline{\text{Dha}}}$,	$\underline{\text{Ni}}$.
($\underline{\textbf{Ma}}$)—	$\underline{\textbf{Ma}}$,	S-Ma,	**Pa,**	$\underline{\underline{\text{Dha}}}$,	$\underline{\underline{\text{Ni}}}$,	0,	**Sa,**	0,	$\underline{\underline{\text{Ga}}}$.
(**Pa**)—	**Pa,**	0,	0,	$\underline{\underline{\text{Ni}}}$,	**Sa,**	$\underline{\text{Ri}}$,	**Ri,**	$\underline{\text{Ga}}$,	$\underline{\textbf{Ma}}$.

The above scale of nine swaras is not used in our Ragas. By omitting 256 $\underline{\text{Ri}}$ and $341\frac{1}{3}$ S-Ma, we get the scale of our modern **'Asavari' Thata.** 4 Ragas are grouped under this Thata.

In the scale of **'Asavari'** Thata $284\frac{4}{9}$ $\underline{\underline{\text{Ga}}}$, $379\frac{7}{27}$ $\underline{\underline{\text{Dha}}}$ and $426\frac{2}{3}$ $\underline{\underline{\text{Ni}}}$ are **Atikomal** swaras. In **Laghu Sa, Ma, Pa** scale the vibrations of $\underline{\underline{\text{Dha}}}$ are $379\frac{7}{27}$ instead of $379\frac{11}{16}$. There is *practically a very minute difference of only two cents between* $379\frac{7}{27}$ and $379\frac{11}{16}$ $\underline{\underline{\text{Dha}}}$. This difference is simply due to accurate mathematical calculation.

It is incorrect to group the Ragas of '**Darbari**' **Thata** under this '**Asavari**' scale. In **Darbari Thata** 288 $\underline{\text{Ga}}$ 384 $\underline{\text{Dha}}$ and 432 $\underline{\text{Ni}}$ are **Komal** swaras, hence the swaras of both the Thatas vary considerably (see chapter VII).

CHAPTER XII

(9) Laghu Sa, Ma, Pa Kakli-Antar 'Ashvakranta' 303$\frac{3}{4}$ Antar Murchana, Modern Name—Thata 'Toadi'.

'**Ashvakranta**' is the sixth Murchana of Sa-Grama starting from the note **Ga**. The above Murchana is developed by shifting the tonic Sa to 303$\frac{3}{4}$ **Antar-Ga of Laghu Sa, Ma, Pa Kakli-Antar** Scale.

In Bharata's fundamental **Shuddha Kakli-Antar** scale the vibrations of Antar-Ga can occasionally be 300 or 303$\frac{1}{27}$ as already explained in chapter VI of this second Part. In **Laghu Sa, Ma, Pa Kakli-Antar** scale the vibrations of Antar-Ga can occasionally be 303$\frac{1}{27}$ or 303$\frac{3}{4}$, thus

3 shrutis	3 shrutis
Ga, A-Ga, Ma	**Ga, A-Ga, Ma.**
288, 303$\frac{1}{27}$, 320	288, 303$\frac{3}{4}$, 320.
$\frac{256}{243} \times \frac{135}{128} = \frac{10}{9}$	$\frac{135}{128} \times \frac{256}{243} = \frac{10}{9}$

The above Murchana starts from 303$\frac{3}{4}$ **Antar-Ga**, thus

3 shrutis

Murchana—A-Ga, Ma, 4 Pa, 4Dha, 2 Ni, K-Ni, Sa, 4 Ri, 2Ga, A-Ga.

Scale— **Sa**, $\underline{\underline{\text{Ri}}}$, 4 $\underline{\underline{\text{Ga}}}$, 4$\underline{\textbf{Ma}}$, 2S-Ma, **Pa**, $\underline{\underline{\text{Dha}}}$, 4 $\underline{\underline{\text{Ni}}}$, 2 S-Ni, $\dot{\textbf{Sa}}$.

Shruti Nos.— 1 5 9 11 13 14 18 20 22

Vibrations—240, 252$\frac{68}{81}$, 284$\frac{4}{9}$, 320, 341$\frac{1}{3}$, 360, 379$\frac{7}{27}$, 426$\frac{2}{3}$, 455$\frac{1}{9}$, 480

Frac. Ratios— $\frac{256}{243} \times \frac{9}{8} \times \frac{9}{8} \times \frac{16}{15} \times \frac{135}{128} \times \frac{256}{243} \times \frac{9}{8} \times \frac{16}{15} \times \frac{135}{128} = 2$

Samvadi Relationship of Swaras.

Notes—	**Sa**,	Ri,	Ga,	**Ma**,	S-Ma,	**Pa**,	Dha,	Ni,	S-Ni.
(**Ma**)—	**Ma**,	0,	Dha,	Ni,	S-Ni,	**Sa**,	Ri,	0,	0.
(**Pa**)—	**Pa**,	Dha,	0,	**Sa**,	0,	0.	Ga.	**Ma**,	S-Ma.

In the above scale $252\frac{68}{81}$ Ri, $284\frac{4}{9}$ Ga, $379\frac{7}{27}$ Dha and $426\frac{2}{3}$ Ni are all **Atikomal** Swaras. In **Laghu Sa, Ma, Pa** scale the vibrations of Atikomal Ri are $252\frac{68}{81}$ instead of $253\frac{1}{8}$. There is practically a very minute difference of only two cents between $252\frac{68}{81}$ and $253\frac{1}{8}$. This difference is due to exact mathematical calculation only, as already stated for $379\frac{7}{27}$ and $379\frac{11}{16}$ Dha in the previous chapter.

As majority of Thatas developed from the above scale are the different varieties of '**Toadi**' Raga, this scale is called the modern '**Toadi**' **Thata.**

The above scale of nine swaras is not used in any of our Ragas. *Janya Thatas of eight and seven swaras are* developed from the Janak scale as under :—

(1) By omitting $341\frac{1}{3}$ S-Ma we get the scale of '**Lachari Toadi**' Thata. 3 Ragas are grouped under this Thata.

(2) By omitting 320 **Ma** and $426\frac{2}{3}$ Ni we get the scale of '**Shuddha Toadi**' Thata. 4 Ragas are grouped under this Thata.

(3 By omitting $341\frac{1}{3}$ S-Ma and $455\frac{1}{9}$ S-Ni we get the scale of '**Bilaskhani Toadi**' Thata. 3 Ragas are grouped under this Thata.

It is incorrect to group Ragas of this Thata under '**Bhairavi**' Thata, as the latter uses all Komal Swaras, as already stated in chapter VII.

(4) By omitting $341\frac{1}{3}$ S-Ma and $426\frac{2}{3}$ Ni we get the scale of '**Rampur-mat Piloo**' Raga.

The popular '**Piloo**' is a Mishra Raga i.e. a combination of several Ragas, hence it can not be grouped under a Thata. The same is the case with the popular **Mishra Bhairavi** and **Khatt** Ragas.

Thus from the scale of nine swaras of **Laghu Sa, Ma, Pa Kakli-Antar 'Ashvakranta'** 303¾ **Antar Murchana** we get the scales of our modern **Lachari Toadi Thata, Shuddha Toadi Thata, Bilaskhani Toadi Thata** and **Rampur-mat Piloo Raga.** In all 11 Ragas are grouped under these Thatas.

Here ends the full description of the three **Laghu Sa, Ma, Pa Kakli-Antar Murchanas,** which are used in our Ragas. Now we will go through the details of two **Joada** (जोड) **Murchanas**, which are used for the classification of nearly 45 Ragas sung during sunrise and sunset.

CHAPTER XIII.

(10) Shuddha Kakli-Antar 'Joada-Rajani' Murchana of Sa-Grama. Modern Name—Janak Thata 'Basant'.

As already stated in chapter IV of this Part, the scale of **Shuddha Kakli-Antar 'Rajani'** Murchana is our modern fundamental scale including Bharata's Kakli-Nishada and Antar-Gandhara swaras, thus

Murchana—Ni, 2 K-Ni, 2 Sa, 3 Ri, 2 Ga, 2 A-Ga, 2 Ma, 4 Pa, 3 Dha, 2 N

Scale—**Sa,** 2 Ri, **2 Ri, 3 Ga, 2 Ma,** 2 S-Ma, **2 Pa, 4 Dha, 3 Ni,** 2 S

This is the modern scale of Sa-wire from the 'mairu' (nut) including the traditional Kakli-Ni and Antar-Ga swaras (see chart No. 3).

An octave is divided into two parts. Notes from **Sa** to **Ma** are called the notes of the first tetrachord (पूर्वांग), and those from **Pa** to **Sa** above are called the notes of the second Tetrachord (उत्तरांग). Joada-Murchanas are developed by combining the notes of the first tetrachords of **Sa, Ma** and **Pa** wires of our stringed instruments. Accordingly, the notes of the first tetrachord of the above scale of Sa-wire will be as follows :—

Swaras—	Sa,	Ri,	Ri,	Ga,	Ma.
Shruti Nos.—		2	4	7	9
Vibrations—	240,	256,	270,	300,	320.

270 Chatushrutik **Ri** is not used in any of the Ragas sung during the last part of the day and night, hence by omitting it the above scale of the first tetrachord of Sa-wire will be 240 **Sa**, 256 Ri, 300 **Ga**, 320 **Ma**.

Now according to this scale of Sa-wire, the swaras of the first tetrachord on **Ma** and **Pa** wires will be as under:—

(Sa-wire)	**Swaras**—	Sa,	Ri,	**Ga,**	**Ma.**
	Vibrations—	240,	256,	300,	320.
(Ma-wire)	**Swaras**—	**Ma,**	S-Ma,	Dha,	Ni.
	Vibrations—	320,	341⅓,	400,	426⅔.
(Pa-wire)	**Swaras**—	**Pa,**	Dha,	**Ni,**	**Ṡa.**
	Vibrations—	360,	384,	450,	480.

By arranging all the above swaras in order of pitch the scale of **Shuddha Kakli-Antar 'Joada-Rajani' Murchana** will be as under:—

Sa,	Ri,	Ga,	Ma,	S-Ma,	**Pa,**	Dha,	Dha,	Ni,	**Ni,**	**Ṡa.**
240,	256,	300,	320,	341⅓,	360,	384,	400,	426⅔,	450,	480.

In all there are ten swaras in the scale. As a rule there can not be more than nine swaras in a Thata, hence by omitting one swara 426⅔ Ni we get the scale of the modern **Janak Thata 'Basant'**, thus

Scale of Janak Thata 'Basant'.

Scale—	**Sa,**	Ri,	**Ga,**	**Ma,**	S-Ma,	**Pa,**	Dha,	Dha,	**Ni,**	**Ṡa.**
Shruti Nos.—		2	7	9	11	13	15	16	20	22.
Vibrations—	240,	256,	300,	320,	341⅓,	360,	384,	400,	450,	480.

In this scale 256 Ri and 384 Dha are **Komal** swaras.

Samvadi Relationship of Swaras.

Notes—	Sa,	$\underline{\text{Ri}}$,	Ga,	$\underline{\text{Ma}}$,	S-Ma,	Pa,	$\underline{\text{Dha}}$,	Dha,	Ni.
($\underline{\text{Ma}}$)—	$\underline{\text{Ma}}$,	S-Ma,	Dha,	0,	0,	Sa,	$\underline{\text{Ri}}$,	0,	Ga.
(Pa)—	Pa,	$\underline{\text{Dha}}$,	Ni,	Sa,	$\underline{\text{Ri}}$,	0,	0,	Ga,	0.

3 Ragas are grouped under this Janak Thata.

Out of the eight Janya Thatas of this Janak Thata '**Basant**' four Janya Thatas are used in our Ragas, namely (1) **Purvi**, (2) **Shree**, (3) **Panchama** and (4) **Purva Kalyan**. They are developed from the Janak Thata '**Basant**' as under :—

(1) By omitting 400 Dha we get the scale of Janya Thata '**Purvi**'. 3 Ragas are grouped under this Janya Thata.

(2) By omitting 320 $\underline{\text{Ma}}$ and 400 Dha we get the scale of Janya Thata '**Shree**'. 11 Ragas are grouped under this Janya Thata.

(3) By omitting 384 $\underline{\text{Dha}}$ we get the scale of Janya Thata '**Panchama**'. 7 Ragas are grouped under this Janya Thata.

This **Panchama Thata** can also be developed from the Shuddha Kakli-Antar '**Margi**' Murchana of **Ma-Grama**. It is the fifth Murchana of Ma-Grama, developed by shifting the tonic **Sa** to **Ni** of the Shuddha Kakli-Antar scale of the Ma-Grama, thus

Muichana—	Ni,	2K-Ni,	2 Sa,	3 Ri,	2 Ga,	2A-Ga,	2 Ma,	3Pa,	4 Dha,	2Ni
Scale—	**Sa**,	2 $\underline{\text{Ri}}$,	2 **Ri**,	3 **Ga**,	2 $\underline{\text{Ma}}$,	2 S-Ma,	2**Pa**.	3Dha,	4 **Ni**,	2 $\dot{\text{Sa}}$,
Shruti Nos.—		2	4	7	9	11	13	16	20	22
Vibrations—	240,	256,	270,	300,	320,	$341\frac{1}{3}$,	360,	400,	450,	480.
rac: Ratios—		$\frac{16}{15}$ ×	$\frac{135}{128}$ ×	$\frac{10}{9}$ ×	$\frac{16}{15}$ ×	$\frac{16}{15}$ ×	$\frac{135}{128}$ ×	$\frac{10}{9}$ ×	$\frac{9}{8}$ ×	$\frac{16}{15}$=2

As stated in chapter IV, the Shuddha Kakli-Antar '**Rajani**' Murchana of Sa-Grama is the **modern fundamental scale of Sa-Grama** including Bharata's Kakli-Ni and Antar-Ga. This Shuddha Kakli-Antar '**Margi**' Murchana of Ma-Grama is the **Modern scale of Ma-Grama** including both the Kakli-Antar swaras of Bharata. By omitting 270 Chatushrutik **Ri** from this modern Ma-Grama Kakli-Antar scale we get the scale of '**Panchama**' **Thata.**

(4) By omitting 320 **Ma** and 384 Dha we get the scale of Janya Thata '**Purva Kalyan**'. 6 Ragas are grouped under this Janya Thata.

In all 30 Ragas are grouped under the Janak Thata '**Basant**' and its four Janya Thatas.

Note—In the scale of Janak Thata '**Basant**' there is a **Shruti Antar** (and not a **Swarantar**) of $\frac{25}{24}$ between 384 Dha and 400 Dha. This discrepancy in the Raga scale is due to the development of the scale from a Joada-Murchana. Musicians generally use 400 Tivra Dha in the arohi (ascent) and 384 Komal Dha in the avarohi (descent). Sometimes only 384 Komal Dha is used in this '**Basant**' Raga. It should be borne in mind that both the Komal 384 Dha and Tivra 400 Dha *can not occur consecutively* (come one after the other) in this Raga.

CHAPTER XIV.

(11) Shuddha Kakli-Antar 'Joada-Rajani' $455\frac{1}{9}$ Kakli Murchana of Sa-Grama.

(Thatas of Ragas sung during Sun-rise).

This Joada-Murchana is developed by shifting the tonic **Sa** to $455\frac{1}{9}$ Kakli-Ni of the first tetrachord of the octave of Sa-wire, thus

Murchana—	K-Ni,	2 Sa,	3 Ri,	2 Ga,	2 A-Ga.
Scale—	Sa,	2 Ri,	3 Ga,	2 Ga,	2 Ma.
Vibrations—	240,	$253\frac{1}{8}$,	$281\frac{1}{4}$,	300,	320.

Frac: Ratios— $\frac{135}{128} \times \frac{10}{9} \times \frac{16}{15} \times \frac{16}{15} = \frac{4}{3}$

$281\frac{1}{4}$ Ga of the scale is not used in any of the Ragas sung during sun-rise, hence by omitting it the scale of the first tetrachord of the octave of Sa-wire will be 240 **Sa**, $253\frac{1}{8}$ Ri, 300 **Ga**, 320 **Ma.**

Now according to this scale of Sa-wire the swaras of the first tetrachord on **Ma** and **Pa** wires will be as under :—

(Sa-Wire)	**Swaras**— **Sa,**	Ri,	**Ga,**	**Ma.**
	Vibrations—240,	$253\frac{1}{8}$,	300,	320.
(Ma-Wire)	**Swaras**— **Ma,**	Ma,	Dha,	Ni.
	Vibrations—320,	$337\frac{1}{2}$,	400,	$426\frac{2}{3}$.
(Pa-Wire)	**Swaras**— **Pa,**	Dha,	**Ni,**	**Ṡa.**
	Vibrations—360,	$379\frac{11}{16}$,	450,	480.

By arranging all the above swaras in order of pitch the scale of **Shuddha Kakli-Antar 'Joada Rajani'** $455\frac{1}{9}$ **Kakli Murchana** will be as under :—

Sa,	Ri,	**Ga,**	**Ma,**	Ma,	**Pa,**	Dha,	Dha,	Ni,	**Ni,**	**Ṡa.**
240,	$253\frac{1}{8}$,	300,	320,	$337\frac{1}{2}$,	360,	$379\frac{11}{16}$,	400,	$426\frac{2}{3}$,	450,	480

In this scale $253\frac{1}{8}$ Ri, $379\frac{11}{16}$ Dha and $426\frac{2}{3}$ Ni are **Atikomal** swaras, while in Janak Thata '**Basant**' and in all its Janya Thatas 256 Ri and 384 Dha were **Komal** swaras, as stated in the previous chapter.

All ragas sung during sun-rise have 'karuna rasa' (compassion sentiment), hence **Atikomal** swaras are used in these Ragas. All Ragas grouped under '**Toadi**' and '**Asavari**' Thatas are alike sung during the first part of the day. They have also 'karuna rasa', hence they too use Atikomal swaras. In Indian music each Raga is connected with a special mood or passion. It is, therefore, fitting that each should *follow a well-ordered plan in its association* with seasons and appropriate hours of day and night. It must always be remembered that in Indian melodies the mood or flavour is of primal importance; and so many things, which appear to the West to be merely fanciful, are important factors for the music of the East. The root meaning of Raga is '**Passion**', and from times immemorial each Raga has been associated with particular passions and emotions. This very fact of putting passion into music means that particular notes will be taken rather flatter or sharper at one time than at another. The law is there of course to be obeyed **as perfectly as possible.** This matter has been fully explained in chapter XVI of Part I.

There are ten swaras in the above scale. By omitting 400 Dha we get the scale of Janak Thata '**Ramkali**' of nine swaras, thus

Scale of Janak Thata 'Ramkali'.

Scale—	Sa,	Ri,	Ga,	Ma,	Ma,	Pa,	Dha.	Ni,	Ni,	Sa.
ruti Nos.—		2	7	9	11	13	15	18	20	22
Vibrations—	240,	$253\frac{1}{8}$,	300,	320,	$337\frac{1}{2}$,	360,	$379\frac{11}{16}$,	$426\frac{2}{3}$,	450,	480

Samvadi Relationship of Swaras.

Notes—	Sa,	Ri,	Ga,	Ma,	Ma,	Pa,	Dha,	Ni,	Ni.
(Ma)—	Ma,	Ma,	0,	Ni,	Ni,	Sa,	Ri,	0,	Ga.
(Pa)—	Pa,	Dha,	Ni,	Sa,	Ri,	0,	0,	Ma,	Ma.

3 Ragas are grouped under this Janak Thata.

Only one Janya Thata of Janak Thata '**Ramkali**' is used in Ragas. It is called Janya Thata '**Bhairava**'. This Janya Thata is developed by omitting $337\frac{1}{2}$ Ma from the Janak Thata. 9 Ragas are grouped under this Janya Thata.

Scale of Thata 'Anand Bhairava'.

This scale is developed by omitting $337\frac{1}{2}$ Ma and $379\frac{11}{16}$ $\underline{\underline{\text{Dha}}}$ from the scale of **Shuddha Kakli-Antar 'Jaoda-Rajani'** $455\frac{1}{9}$ **Kakli Murchana**, thus

Scale—	Sa,	$\underline{\underline{\text{Ri}}}$,	Ga,	$\underline{\text{Ma}}$,	Pa,	Dha,	$\underline{\underline{\text{Ni}}}$,	Ni,	$\dot{\text{Sa}}$.
Shruti Nos.—		2	7	9	13	16	18	20	22
Vibrations—	240,	$253\frac{1}{8}$,	300,	320,	360,	400,	$426\frac{2}{3}$,	450,	480

In this scale 400 Tivra **Dha** is used. It stands in samvadi relationship with 300 Tivra **Ga**. Samvadi relationship of all the other swaras is just the same as stated above in Janak Thata '**Ramkali**'. Only 2 Ragas are grouped under this scale.

Scale of Raga 'Saurashtra'.

This scale is developed by omitting $337\frac{1}{2}$ Ma and $426\frac{2}{3}$ $\underline{\underline{\text{Ni}}}$ from the scale of **Shuddha Kakli-Antar 'Joada-Rajani'** $455\frac{1}{9}$ **Kakli Murchana**, thus

Scale—	Sa,	$\underline{\underline{\text{Ri}}}$,	Ga,	$\underline{\text{Ma}}$,	Pa,	$\underline{\underline{\text{Dha}}}$,	Dha,	Ni,	$\dot{\text{Sa}}$.
Shruti Nos.—		2	7	9	13	15	16	20	22
Vibrations—	240,	$253\frac{1}{8}$,	300,	320,	360,	$379\frac{11}{16}$,	400,	450,	480.

In all 15 Ragas are grouped under this Shuddha Kakli-Antar '**Joada-Rajani**' $455\frac{1}{9}$ Kakli Murchana i. e. the scale of all Ragas sung during sun-rise. In these Ragas 320 Komal $\underline{\text{Ma}}$ has prominence over $337\frac{1}{2}$ Tivratar Ma. The reverse is the case in Ragas sung during sunset.

Here ends the full description of the traditional eleven Murchanas under which the modern Thatas and about 170 Ragas, that are in general use to-day, are grouped. A detailed chart of the classification of all these Ragas with their correct **Vadi** and **Samvadi** swaras is annexed herewith, which will be of great help to all the students of Indian music for learning the **accurate pitch** and **samvadi relationship** of their notes. Many more Ragas can be grouped under these eleven Murchanas, but unfortunately they have passed away into oblivion owing to long disuse.

Detailed theories and Lakshana-songs of Ragas are given in author's Hindi book '**Raga Lakshana-Geet Malika**' in two parts.

(Chart No. 12)

22 Notes of the Shruti-Scale and their use in the Modern 170 Ragas.

Notes.	Thatas of Ragas.	Notes.	Thatas of Ragas.
240 **Sa**	Common Tonic.	$341\frac{1}{3}$ S-Ma	General use.
$252\frac{68}{81}$ $\underline{\underline{\text{Ri}}}$	**Toadi.**	360 **Pa**	General use.
$253\frac{1}{8}$ $\underline{\underline{\text{Ri}}}$	Thatas of sunrise.	$379\frac{7}{27}$ $\underline{\underline{\text{Dha}}}$	**Toadi**, **Asavari**, etc.
256 $\underline{\text{Ri}}$	**Bhairavi**, **Multani**, etc.	$379\frac{11}{16}$ $\underline{\underline{\text{Dha}}}$	Thatas of sunrise.
$266\frac{2}{3}$ Ri	**Bageshri** and **Deshkar.**	384 $\underline{\text{Dha}}$	**Bhairavi**, **Darbari**, etc.
270 **Ri**	General use.	400 Dha	General use.
$284\frac{4}{9}$ $\underline{\underline{\text{Ga}}}$	**Asavari**, **Toadi**, etc.	405 **Dha**	**Sindh Kafi**, **Bihaga**, etc.
288 $\underline{\text{Ga}}$	**Kafi**, **Bhairavi**, etc.	$426\frac{2}{3}$ $\underline{\underline{\text{Ni}}}$	**Kedara**, **Bageshri**, etc.
300 **Ga**	General use.	432 $\underline{\text{Ni}}$	**Kafi**, **Bhairavi**, etc.
$303\frac{11}{27}$ S-Ga	**Sindh Kafi.**	450 **Ni**	**Bihaga**, **Shankra**, etc.
320 **Ma**	General use.	$455\frac{1}{9}$ S-Ni	**Kedara**, **Toadi**, etc.
$337\frac{1}{2}$ $\overline{\text{Ma}}$	**Ramkali.**		

(Latest Research)

Chart of Raga-Classification According to the Traditional Murchana System.

Names of Murchanas and modern Thatas.	Names of Ragas with their Vadi and Samvadi swaras.
(1) **Shuddha Kakli-Antar 'Matsarikruta' Murchana of Sa-Grama.** Modern name—**Janak Thata 'Kedara'.** **Sa. Ri. Ga.** $\underline{\text{Ma}}$. S-Ma. **Pa.** Dha. Ni, S-Ni, **Ṡa.** 4 7 9 11 13 16 $\overline{\overline{18}}$ 20 22 240, 270. 300, 320. 341⅓, 360, 400. 426⅔, 455⅑. 480	1 Kedara ($\underline{\textbf{Ma}}$ **Sa**). 2 Nut-Kedara ($\underline{\textbf{Ma}}$ **Sa**). 3 Kamode (**Pa Ri**). 4 Chaya-Nut (**Ri Pa**). 5 Hamir (Dha **Ga**), 6 Shiam (**Ri Pa**), 7 Goud Saranga (**Ga** Dha), 8 Shuddha Saranga (**Ri Pa**).
Janya Thata 'Shuddha Kalyan'. **Sa. Ri. Ga.** $\underline{\text{Ma}}$, S-Ma, **Pa.** Dha, S-Ni, **Ṡa** 4 7 9 11 13 16 20 22 240, 270. 300, 320, 341⅓. 360. 400. 455⅑, 480	1 Shuddha Kalyan (**Ga** Dha or **Ri Pa**), 2 Yaman Kalyan (**Ga** Dha). 3 Yamni Bilaval (Dha **Ga**), 4 Maluha Kedara (**Sa Pa**). 5 Pahadi (**Ga** Dha). 6 Anandi (**Pa Sa**).
Janya Thata 'Yaman' **Sa. Ri, Ga.** S-Ma. **Pa,** Dha. S-Ni, **Ṡa** 4 7 11 13 16 20 22 240, 270, 300, 341⅓, 360, 400, 455⅑, 480	1 Yaman (**Ga** Dha or S-Ni S-Ma), 2 Bhupa (**Ga** Dha), 3 Jait Kalyan (**Pa Sa**), 4 Hansdhvani (**Sa Pa**).

Janya Thata 'Khamaja'

Sa,	**Ri**,	**Ga**,	**Ma**,	**Pa**,	Dha,	Ni,	S-Ni,	**Ṡa**
	4	7	9	13	16	18	20	22
240,	270,	300,	320,	360,	400,	$426\frac{2}{3}$,	$455\frac{1}{9}$,	480

1 Khamaja (**Ga** Dha), 2 Zinzoati (**Ga** Dha), 3 Tilang (**Sa Pa**), 4 Khambavati (**Ga** Dha), 5 Rageshri (**Ma Sa**), 6 Tilaka-Kamode (**Sa Pa**), 7 Mand (**Sa Ma** or **Pa**), 8 Bihagada (**Pa Sa**), 9 Alhayia Bilaval (Dha **Ga**), 10 Shukla Bilaval (**Ma Sa**), 11 *Nut-Bilaval* (**Ma** *Sa*), 12 Devgiri (**Sa Pa**), 13 Kukubha (**Pa Ri**), 14 Sarparda (**Sa Pa**), 15 Lachashakha (Dha **Ga**), 16 Shuddha Malhar (**Ma Sa**), 17 Goud Malhar (**Ma Sa**), 18 Nut-Malhar (**Ma** Sa).

Janya Thata 'Shuddha Bilaval'

Sa,	**Ri**,	**Ga**,	**Ma**,	**Pa**,	Dha,	S-Ni,	**Ṡa**.
	4	7	9	13	16	20	22
240,	270,	300,	320,	360,	400,	$455\frac{1}{9}$,	480

1 Shuddha Bilaval (Dha **Ga**), 2 Shuddha Nut (**Ma** Sa), 3 Durga (**Sa Ma**), 4 Jaldhar (**Ma** Sa), 5 Bhinna Shadaja (Dha **Ga**), 6 Ham Kalyan (**Sa Pa**), 7 Savani Kalyan (**Sa Pa**), 8 Gunkali (**Sa Pa**), 9 Bhavasakha (**Ma Sa**), 10 *Ashagoudi* (**Sa Pa**), 11 Pratapvarali (**Ri Pa**), 12 Nagsvaravli (**Sa Ma**).

Chart of Raga-Classification According to the Traditional Murchana System.

Names of Murchanas and modern Thatas.	Names of Ragas with their Vadi and Samvadi swaras.
Janya Thata 'Kamboji' **Sa**, **Ri**, **Ga**, **Ma**, **Pa**, Dha, Ni, **Ṡa** 4 7 9 13 16 18 22 240, 270, 300, 320, 360, 400, $426\frac{2}{3}$, 480	1 Kamboji (**Sa Pa**), 2 Madhurdhvani (**Ma Sa**).
(2) **Shuddha Antar 'Rajani' Murchana of Sa-Grama. Modern name—Thata 'Bihaga'.** **Sa**, **Ri**, **Ga**, **Ma**, S-Ma, **Pa**, **Dha**, Ni, **Ṡa** 4 7 9 11 13 17 20 22 240, 270, 300, 320, $341\frac{1}{3}$, 360, 405, 450, 480	1 Bihaga (**Ga Ni**), Shankra (**Ni Ga**).
(3) **Shuddha 'Souvari' Murchana of Ma-Grama. Modern name—Raga 'Deshkara'.** **Sa**, Ri, **Ga**, **Pa**. Dha, **Ṡa** 3 7 13 16 22 240, $266\frac{2}{3}$, 300, 360, 400, 480	1 Deshkara (Dha Ri or **Ga**.).

(4) Shuddha 'Uttarmandra' Murchana of Ṡa-Grama. Modern name—Raga 'Bageshri'.

Sa,	Ri,	Ga,	Ma,	Pa,	Dha,	Ni,	Ṡa.
	3	5	9	13	16	18,	22.
240,	266$\frac{2}{3}$,	284$\frac{4}{9}$,	320,	360,	400,	426$\frac{2}{3}$,	480.

1 Bageshri (Ma Sa).

By including **Antar-Ga** i. e. modern 303$\frac{11}{27}$ S-Ga we get '**Malgunji**' Raga (**Ma** Sa).

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(5) Shuddha Kakli-Antar 'Kalopanta' Murchana of Ma-Grama. Modern name—Janak Thata 'Sindh Bhairavi'.

Sa,	Ri,	Ri,	Ga,	Ma,	Pa,	Dha,	Dha,	Ni,	Ṡa.
	2	4	6	9	13	15	17	19	22.
240,	256,	270,	288,	320,	360,	384,	405,	432,	480.

1 Sindh Bhairavi (**Pa Sa** or Dha Ga).

Janya Thata 'Shuddha Bhairavi'.

Sa,	Ri,	Ga.	Ma,	Pa,	Dha,	Ni,	Ṡa.
	2	6	9	13	15	19	22.
240,	256,	288,	320,	360,	384,	432,	480.

1 Shuddha Bhairavi (Dha Ga or **Ma Sa**),

2 Malkouns (Ma Sa), 3 Bhupal (Dha Ga).

Note–'**Mishra Bhairavi**' Raga can not be grouped under a Thata.

Chart of Raga-Classification According to the Traditional Murchana System.

Names of Murchanas and modern Thatas.	Names of Ragas with their Vadi and Samvadi swaras.
Janya Thata 'Darbari'. Sa, Ri, Ga, Ma, Pa, Dha, Ni, Ṡa 4 6 9 13 15 19 22 240, 270, 288, 320, 360, 384, 432, 480	1 Darbari (Ga Dha), 2 Adana (Ṡa Pa), 3 Suha (Ma Sa), 4 Nayaki (Ma Sa), 5 Kaunsi (Ma Sa).
(6) **Shuddha Kakli-Antar 'Ashvakranta' 300 Antar Murchana of Sa-Grama. Modern name—Thata 'Multani'.** Sa, Ri, Ga, S-Ma, Pa, Dha, S-Ni, Ṡa 2 6 11 13 15 20 22 240, 256, 288, $341\frac{1}{3}$, 360, 384, $455\frac{1}{9}$, 480	1 Multani (Pa Sa), 2 Uttari Basant (Ṡa Pa).
(7) **Laghu Sa, Ma, Pa, Kakli-Antar 'Uttarmandra' Murchana. Modern name—Janak Thata 'Sindh Kafi'.** Sa, Ri, Ga, S-Ga, Ma, Pa, Dha, Ni, S-Ni, Ṡa. 4 6 7 9 13 17 19 20 22 240, 270, 288, 300, 320, 360, 405, 432, $455\frac{1}{9}$, 480	1 Sindh Kafi (Sa Pa), 2 Kafi (Pa Ri), 3 Sindura (Sa Pa), 4 Daisi (Pa Ri), 5 Barva (Ri Pa), 6 Patmanjari (Ri Pa), 7 Sorath (Ri Pa), 8 Dais (Pa Ri), 9 Jaijaivanti (Ri Pa), 10 Gara (Sa Ma), 11 Hanskankany (Pa Sa), 12 Patdi-

Correction.

The vibrations of S-Ga are $303\frac{1}{2}\frac{1}{7}$ and not 300 in the above scale.

Janya Thata 'Kanada'.

Sa,	Ri,	Ga,	Ma,	Pa,	Dha,	Ni,	S-Ni,	Ṡa.
	4	6	9	13	17	19	20	22
240,	270,	288,	320,	360,	405,	432,	$455\frac{1}{9}$,	480

paki (**Ma Sa**), 13 Lankadahan (**Ri Pa**), 14 Ramdasi Malhar (**Ma Sa**), 15 Rupmanjari Malhar (**Sa Pa**), 16 Dais Malhar (**Ri Pa**), 17 Charjuki Malhar (**Ri Pa**), 18 Dhudia Malhar (**Ri Pa**).

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1 Suha (**Ma Sa**), 2 Sughrai (**Pa Sa**), 3 Devsakha (**Sa Ma**), 4 Nayaki (**Ma Sa**), 5 Shahana (**Sa Pa** or **Ma**), 6 Adana (**Ṡa Pa**), 7 Jaijaivanty Kanada (**Ri Pa**), 8 Mundhrik Kanada (**Ri Pa**), 9 Sindura Kanada (**Sa Pa**), 10 Bahar (**Ma Sa**), 11 Miya Malhar (**Sa Pa**), 12 Chanchalsaski Malhar (**Sa Pa**), 13 Soor Malhar (**Sa Ma** or **Pa**), 14 Maigh (**Sa, Ma,** or **Pa**), 15 Lankadahan Saranga (**Ri Pa**), 16 Bindrabani Saranga (**Ri Pa**) 17 Madhumad Saranga (**Ri Pa**), 18 Badhatuns Saranga (**Ma Sa**), 19 Miyaka Saranga (**Ri Pa**), 20 Samant Saranga (**Ri Pa**), 21 Noor Saranga (**Ri Pa**).

Chart of Raga-Classification According to the Traditional Murchana System.

Names of Murchanas and modern Thatas.	Names of Ragas with their Vadi and Samvadi swaras.
Janya Thata 'Shuddha Kafi'. Sa, Ri, Ga, Ma, Pa. Dha. Ni, Ṡa. 4 6 9 13 17 19 22. 240, 270, 288, 320, 360, 405, 432, 480.	1 Shuddha Kafi (**Pa Ri**;, 2 Bhimpalasi (**Ma Sa**), 3 Dhanashri (**Pa Sa**), 4 Dhani (Ga Ni).
(8) **Laghu Sa, Ma, Pa Kakli-Antar 'Uttarayata' Murchana. Modern name—Thata 'Asavari'.** Sa, Ri. Ga, Ma. Pa. Dha, Ni. Ṡa. 4 5 9 13 14 18 22. 240, 270, $284\frac{4}{9}$, 320. 360, $379\frac{7}{27}$. $426\frac{2}{3}$. 480.	1 Asavari (Dha Ga). 2 Joanpuri (Dha Ga or **Pa Sa**), 3 Devagandhara (**Pa Sa**), 4 Daisi of Asavari Thata (**Pa Ri**).
(9) **Laghu Sa, Ma. Pa Kakli-Antar 'Ashvakranta' $303\frac{3}{4}$ Antar Murchana. Modern name—Thata 'Toadi'. Thata 'Lachari Toadi.'** Sa, Ri, Ga, Ma. Pa, Dha, Ni, S-Ni, Ṡa. 1 5 9 13 14 18 20 22. 240, $252\frac{68}{81}$, $284\frac{4}{9}$, 320, 360, $379\frac{7}{27}$, $426\frac{2}{3}$, $455\frac{1}{9}$, 480.	1 Lachari Toadi (**Pa Sa**). 2 Komal Bhairava (Dha Ri). 3 Khatta (Dha Ga). **Note–'Mishra Khatta'** Raga can not be grouped under a Thata.

Thata 'Shuddha Toadi.'

Sa,	Ri,	Ga,	S-Ma,	Pa,	Dha,	S-Ni,	Ṡa.
	1	5	11	13	14	20	22.
240,	$252\frac{68}{81}$,	$284\frac{4}{9}$,	$341\frac{1}{3}$,	360,	$379\frac{7}{27}$,	$455\frac{1}{9}$,	480.

Thata 'Bilaskhani Toadi.'

Sa,	Ri,	Ga,	Ma,	Pa,	Dha,	Ni,	Ṡa.
	1	5	9	13	14	18	22.
240,	$252\frac{68}{81}$,	$284\frac{4}{9}$,	320,	360,	$379\frac{7}{27}$,	$426\frac{2}{3}$,	480.

Thata 'Rampur-mat Piloo.'

Sa,	Ri,	Ga,	Ma.	Pa,	Dha,	S-Ni,	Ṡa.
	1	5	9	13	14	20	22.
240,	$252\frac{68}{81}$,	$284\frac{4}{9}$,	320,	360.	$379\frac{7}{27}$,	$455\frac{1}{9}$,	480.

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1 Shuddha Toadi (Dha Ga), 2 Bahaduri Toadi (Dha Ga), 3 Miyaki Toadi (Dha Ga), 4 Gujari Toadi (Dha Ga).

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1 Bilaskhani Toadi (Dha Ga), 2 Uttari Asavari (Dha Ga), 3 Gandhari (Dha Ga).

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1 Rampur-mat Piloo (Ga Dha).

Note:—'**Mishra Piloo**' Raga can not be grouped under a Thata.

Chart of Raga-Classification According to the Traditional Murchana System.

Names of Murchanas and modern Thatas.	Names of Ragas with their Vadi and Samvadi swaras.
(10) Shuddha Kakli-Antar 'Joada-Rajani' $455\frac{1}{3}$ Kakli Murchana of Sa-Grama. Modern Thatas of Ragas sung during sunrise. **Janak Thata 'Ramkali'** Sa, $\underline{\underline{\text{Ri}}}$, Ga, $\underline{\text{Ma}}$, Ma, Pa, $\underline{\underline{\text{Dha}}}$, $\underline{\underline{\text{Ni}}}$, Ni, Ṡa. 2 7 9 11 13 15 18 20 22. 240, $253\frac{1}{3}$, 300, 320, $337\frac{1}{2}$, 360, $379\frac{11}{16}$, $426\frac{2}{3}$, 450, 480.	1 Ramkali ($\underline{\underline{\text{Dha}}}$ $\underline{\underline{\text{Ri}}}$), 2 Kalingda ($\underline{\underline{\text{Dha}}}$ $\underline{\underline{\text{Ri}}}$, or $\underline{\text{Ma}}$ or $\overline{\text{Pa}}$ $\overline{\text{Sa}}$), 3 Prabhata ($\underline{\text{Ma}}$ Sa).
Janya Thata 'Bhairava' Sa, $\underline{\underline{\text{Ri}}}$, Ga, $\underline{\text{Ma}}$, Pa, $\underline{\underline{\text{Dha}}}$, $\underline{\underline{\text{Ni}}}$, Ni, Ṡa. 2 7 9 13 15 18 20 22. 240, $253\frac{1}{3}$, 300, 320, 360, $379\frac{11}{16}$, $426\frac{2}{3}$, 450. 480.	1 Bhairava ($\underline{\underline{\text{Dha}}}$ $\underline{\underline{\text{Ri}}}$), 2 Bangal Bhairava ($\underline{\underline{\text{Dha}}}$ $\underline{\underline{\text{Ri}}}$), 3 Hijaj ($\underline{\text{Ma}}$ Sa), 4 Devaranjani (Sa $\underline{\text{Ma}}$), 5 Joagiya ($\underline{\text{Ma}}$ Sa), 6 Zilafa ($\underline{\text{Ma}}$ Sa), 7 Bibhasa ($\underline{\underline{\text{Dha}}}$ $\underline{\underline{\text{Ri}}}$), 8 Gunkri ($\underline{\underline{\text{Dha}}}$ $\underline{\underline{\text{Ri}}}$), 9 Deshgoud ($\underline{\underline{\text{Dha}}}$ $\underline{\underline{\text{Ri}}}$).
Thata 'Ananda Bhairava' Sa, $\underline{\underline{\text{Ri}}}$, Ga, $\underline{\text{Ma}}$, Pa, Dha, $\underline{\underline{\text{Ni}}}$. Ni, Ṡa. 2 7 9 13 16 18 20 22. 240, $253\frac{1}{3}$, 300, 320, 360, 400, $426\frac{2}{3}$, 450, 480.	1 Ananda Bhairava (Sa $\underline{\text{Ma}}$), 2 Ahira Bhairava ($\underline{\text{Ma}}$ Sa).

Raga 'Sourashtra Bhairava'

Sa,	Ri,	Ga,	Ma,	Pa,	Dha.	Dha,	Ni,	Ṡa.
	2	7	9	13	15	16	20	22.
240,	$253\frac{1}{8}$,	300,	320.	360,	$379\frac{11}{16}$.	400.	450,	480.

1 Sourashtra Bhairava (**Ma** Sa).

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(11) Shuddha Kakli-Antar 'Joada-Rajani' Murchana of Sa-Grama. Modern name—Janak Thata 'Basant'.

Sa,	Ri,	Ga,	Ma,	S-Ma,	Pa,	Dha,	Dha,	Ni,	Ṡa.
	2	7	9	11	13	15	16	20	22.
240,	256,	300,	320,	$341\frac{1}{3}$,	360,	384,	400,	450,	480.

1 Basant (**Sa, Pa**), 2 Basant Panchama (**Sa Pa**), 3 Sajgiri (**Ga Ni**).

Janya Thata 'Purvi'

Sa,	Ri,	Ga,	Ma,	S-Ma,	Pa.	Dha,	Ni,	Ṡa.
	2	7	9	11	13	15	20	22.
240,	256,	300,	320,	$341\frac{1}{3}$,	360.	384,	450,	480.

1 Purvi (**Ga, Ni**), 2 Paraja (**Sa Pa**), 3 Gouri (Ri Dha).

Janya Thata 'Shree'

Sa,	Ri,	Ga,	S-Ma,	Pa,	Dha,	Ni,	Ṡa.
	2	7	11	13	15	20	22.
240,	256,	300,	$341\frac{1}{3}$,	360,	384,	450,	480.

1 Shree (Ri Dha), 2 Gouri (Ri Dha), 3 Puriya-Dhanashree (**Pa Sa**). 4 Jaitshree (**Pa Sa** or **Ga Ni**), 5 Malshree (**Sa Pa**), 6 Malvi (**Sa Pa**), 7 Dipaka (**Sa Pa**), 8 Tirvana (Ri Dha). 9 Tanki (**Pa Sa**), 10 Raiva (**Sa Pa**), 11 Hansnarayani (**Pa Sa**), 12 Manohar (Ri Dha).

Chart of Raga-Classification According to the Traditional Murchana System.

Names of Murchanas and modern Thatas.	Names of Ragas with their Vadi and Samvadi swaras.
Janya Thata 'Panchama'. Sa, Ri, Ga, Ma. S-Ma. Pa, Dha, Ni, Ṡa. 2 7 9 11 13 16 20 22. 240, 256, 300, 320, 341⅓. 360. 400. 450, 480.	1 Panchama (**Sa Ma**), 2 Lalita Panchama uses 400 Dha or 384 Dha. **Ma Sa**). 3 Lalita (**Ma Sa**). 4 Maigh Ranjani (**Ma Sa**). 5 Soahani (Dha **Ga**), 6 Marga Hindole (Dha **Ga**). 7 Hindole (Dha **Ga**). 8 Bhatiyar (**Ma Sa**). 9 Bhankar (**Pa Sa**).
Janya Thata 'Purva Kalyan'. Sa, Ri. Ga. S-Ma. Pa. Dha. Ni. Ṡa. 2 7 11 13 16 20 22. 240, 256. 300. 341⅓, 360, 400. 450. 480.	1 Purva Kalyan (**Pa Sa** or **Ga Ni**): 2 Maligoura (**Ga Ni**). 3 Varati (**Ga** Dha). 4 Marva (**Ga** Dha. or Ri 384 Dha). 5 Puriya (**Ga Ni**). 6 Jait (**Pa Sa**).

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THE END

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